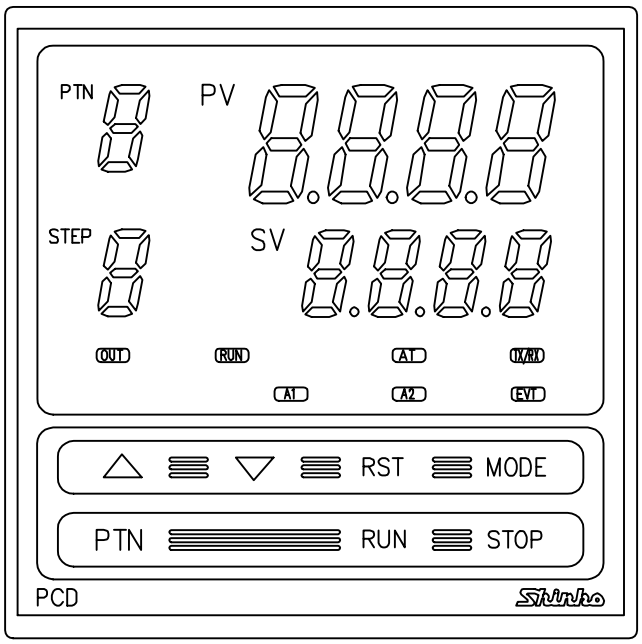
PROGRAMMABLE CONTROLLER

PCD-33A

INSTRUCTION MANUAL



Shinko

Preface

Thank you for purchasing our Programmable Controller PCD-33A. This manual contains instructions for the mounting, functions, operation and notes when operating the PCD-33A. To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications of the PCD-33A and the contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- Measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

SAFETY PRECAUTIONS (Be sure to read these precautions before using our products.)

The safety precautions are classified into categories: “Warning” and “Caution”.
Depending on the circumstances, procedures indicated by ⚠ Caution may cause serious results, so be sure to follow the directions for usage.

⚠ Warning Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.

⚠ Caution Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

⚠ Warning

- To prevent an electric shock or fire, only Shinko or other qualified service personnel may handle the inner assembly.
- To prevent an electric shock, fire or damage to instrument, parts replacement may only be undertaken by Shinko or other qualified service personnel.

⚠ Safety precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after consulting purpose of use with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protection equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Also proper periodic maintenance is required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

Caution with respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument.
In the case of resale, ensure that this instrument is not illegally exported.

1. Installation precautions

⚠ Caution

This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2
Ensure the mounting location corresponds to the following conditions:

- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- Few mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, and no icing
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit
- Take note that ambient temperature of this unit must not exceed 50℃ (122℉) if mounted through the control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

Note: Although the case of this instrument is made of flame-resistant resin, do not install this instrument on or near flammable material.

2. Wiring precautions

⚠ Caution

- Use a solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the PCD-33A.
- The terminal block of this instrument is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw (M3).
- Tighten the terminal screw (M3) within the specified torque. If excessive force is applied to the screw when tightening, the screw (M3) or case may be damaged.
- Do not apply a commercial power source to the sensor which is connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may be burnt out.
- This controller has no built-in power switch or fuse. It is necessary to install them near the controller.
  (Recommended fuse: Time-lag fuse, Rated voltage 250V AC, Rated current 2A)
- For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).

3.Operation and maintenance precautions

⚠ Warning

- It is recommended to perform auto-tuning during trial run.
- Do not touch live terminals. This may cause electric shock or problems in operation.
- Turn the power supply to the instrument OFF before retightening the terminal. Working on or touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.
- Be sure to turn the power to the PCD-33A OFF before cleaning.
- Use a soft, dry cloth when cleaning the instrument.
  (Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object or press hard on it.

Abbreviations used in this manual

Symbol	Term
PV	Process variable
SV	Desired value
MV	Output manipulated variable
OUT	Control output
AT	Auto-tuning

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1. Model

1.1 Model

Fill in the squares with the alphanumeric characters to represent the function or type.

[Example]

PCD-33A – R / M , C5 ,

- C5 — Option: Serial communication
- M — Input: Multi-input
- R — Control output (OUT): Relay contact output

Standard model

P C D – 3 3 A – □ / M, □ □ □ □ □						Series name: PCD-300
Control action	3					PID control action
Alarm		A				Alarm 1 (A1), Alarm 2 (A2) (*1)
Control output (OUT)			R			Relay contact
			S			Non-contact voltage
			A			DC current
Input				M		K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26), Pt100, JPt100, 4-20mA DC, 0-20mA DC, 0-1V DC, 0-5V DC, 1-5V DC, 0-10V DC (*2)
Supply voltage						100 to 240V AC (standard)
				1		24V AC/DC 50/60Hz (*3)
Options					C5	Serial communication (EIA RS-485) (*4)
					SVTC	Set value digital transmission (*4)
					P24	Insulated power output (*5)
					TC	Electric shock protection terminal cover
					BK	Color: Black Front panel: Dark gray Case: Black

*1: 9 types of alarm and no alarm action can be selected by front keypad operation.

*2: One input type can be selected from 10 thermocouple types (K, J, R, S, B, E, T, N, PL-Ⅱ, C (W/Re5-26), 2 RTD types (Pt100, JPt100), 2 DC current types (4-20mA DC, 0-20mA) and 4 DC voltage types (0-1V DC, 0-5V DC, 1-5V DC, 0-10V DC) by the front keypad operation.

*3: For the supply voltage, 100 to 240V AC is standard. “1” is entered for 24V AC/DC.

*4: If this option is added, standard external operation cannot be used.
C5 and SVTC options cannot be added together.

*5: If this option is added, standard Alarm 2 (A2) cannot be used.

Characters used in this manual

Indication	-1	0	1	2	3	4	5	6	7	8	9	℃	℉	
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉	
Indication	A	B	C	D	E	F	G	H	I	J	K	L	M	
Alphabet	A		B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	S	T	U	V	W	X	Y	Z	
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	

1.2 Rated input

(Table 1.2-1)

Input type		Input range		Resolution
Thermo-couple	K	-200 to 1370 ℃	-320 to 2500 ℉	1℃(℉)
		-199.9 to 400.0 ℃	-199.9 to 750.0 ℉	0.1℃(℉)
	J	-200 to 1000 ℃	-320 to 1800 ℉	1℃(℉)
	R	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
	S	0 to 1760 ℃	0 to 3200 ℉	1℃(℉)
	B	0 to 1820 ℃	0 to 3300 ℉	1℃(℉)
	E	-200 to 800 ℃	-320 to 1500 ℉	1℃(℉)
	T	-199.9 to 400.0 ℃	-199.9 to 750.0 ℉	0.1℃(℉)
	N	-200 to 1300 ℃	-320 to 2300 ℉	1℃(℉)
	PL-Ⅱ	0 to 1390 ℃	0 to 2500 ℉	1℃(℉)
	C (W/Re5-26)	0 to 2315 ℃	0 to 4200 ℉	1℃(℉)
RTD	Pt100	-199.9 to 850.0 ℃	-199.9 to 999.9 ℉	0.1℃(℉)
		-200 to 850 ℃	-300 to 1500 ℉	1℃(℉)
	JPt100	-199.9 to 500.0 ℃	-199.9 to 900.0 ℉	0.1℃(℉)
		-200 to 500 ℃	-300 to 900 ℉	1℃(℉)
DC current	4 to 20mA DC	-1999 to 9999 *1, *2		1
	0 to 20mA DC	-1999 to 9999 *1, *2		1
DC voltage	0 to 1V DC	-1999 to 9999 *1		1
	0 to 5V DC	-1999 to 9999 *1		1
	1 to 5V DC	-1999 to 9999 *1		1
	0 to 10V DC	-1999 to 9999 *1		1

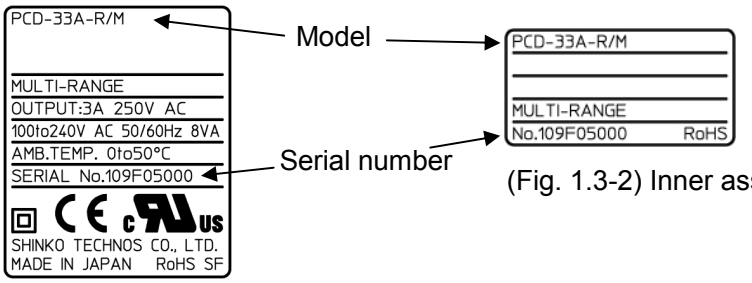
(*1) For DC current and voltage inputs, scaling and decimal point place are changeable.
(*2) For DC current input, 50Ω shunt resistor (sold separately) must be connected.

1.3 How to read the model label

⚠ Warning

Do not take the inner assembly out or touch the terminal with the power supply ON when confirming the model label.
Touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.

Model labels are attached to the case and the left side of the inner assembly.
[Example]

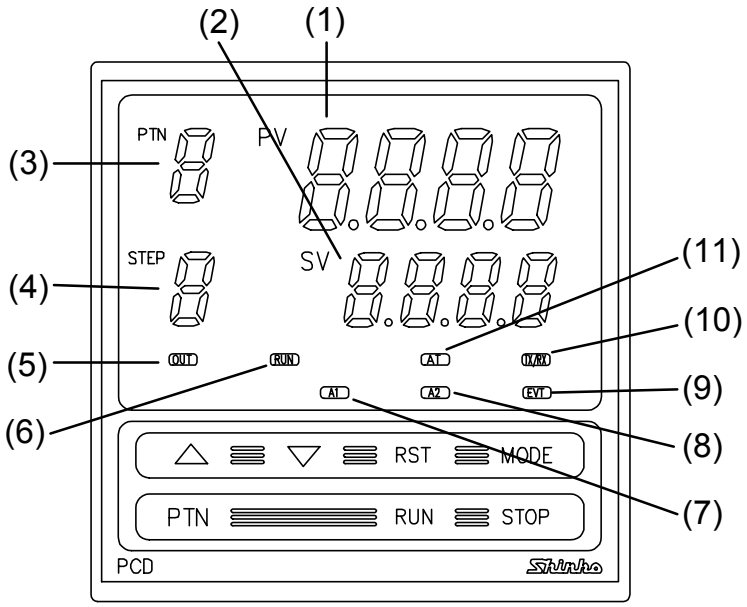


(Fig. 1.3-1) Case label

(Fig. 1.3-2) Inner assembly label

2 Name and functions of sections

2.1 Displays and indicators



(Fig. 2.1-1)

(1) **PV display** (Red)
Indicates the PV (Process variable), or setting characters in the setting mode.

(2) **SV display** (Green)
Indicates the SV (desired value) or step SV, or each set value in the setting mode.

(3) **PTN display** (Green)
Indicates the Pattern number.

(4) **STEP display** (Green)
Indicates the step number.
While Wait function is working, the related step number flashes.

(5) **OUT indicator** (Green)
Lights when the control output (OUT) is on.
(For the current output type, it flashes at a cycle of every 250ms corresponding to the output manipulated variable.)

(6) **RUN indicator** (Red)
Lights while program control is performing.
Flashes while program control is held.

(7) **A1 indicator** (Red)
Lights when Alarm 1 (A1) output is on.

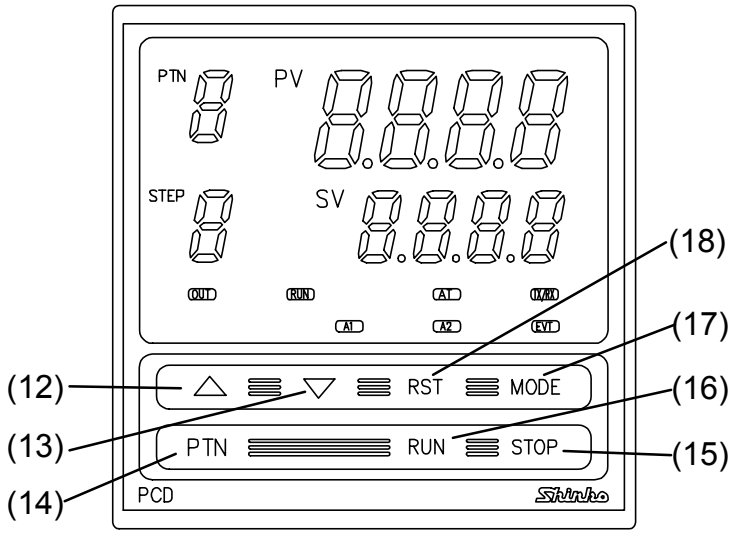
(8) **A2 indicator** (Red)
Lights when Alarm 2 (A2) output is on.

(9) **EVT indicator** (Red)
Lights when an output type (Time signal output, Pattern end output or Run output) selected during Event output function selection is on.

(10) **TX/RX indicator** (yellow)
Flashes while transmitting data via Serial communication.
(Data sending: Lit, Data receiving: Unlit)

(11) **AT indicator** (yellow)
Flashes while auto-tuning is being performed.

2.2 Keys



(Fig. 2.2-1)

(12) △ **(Increase Key)** : Increases the numeric value on the SV display or switches to the next item.
(13) ▽ **(Decrease Key)** : Decreases the numeric value on the SV display or switches to the next item.
(14) **PTN (Pattern Key)** : Selects a program pattern number.
(15) **STOP (STOP Key)** : Cancels the program control or the pattern end output.
(16) **RUN (RUN Key)** : Starts a program control, or advances to the next step after cancelling the current step (Advance function).
(17) **MODE (MODE Key)**: Switches to the next setting mode, and registers the set values.
(18) **RST (Reset Key)** : Cancels the setting mode, then reverts to the Program standby mode or Program control run mode.

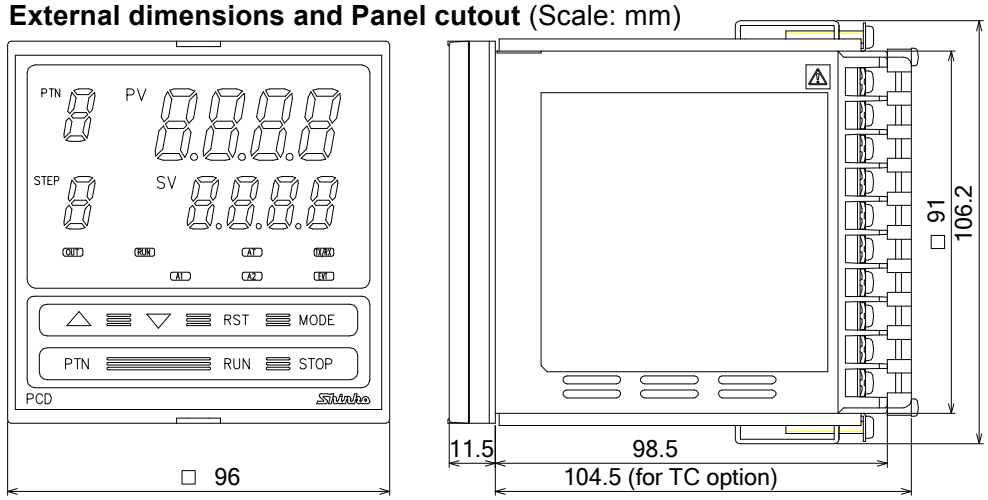
3. Mounting to the control panel

3.1 Site selection

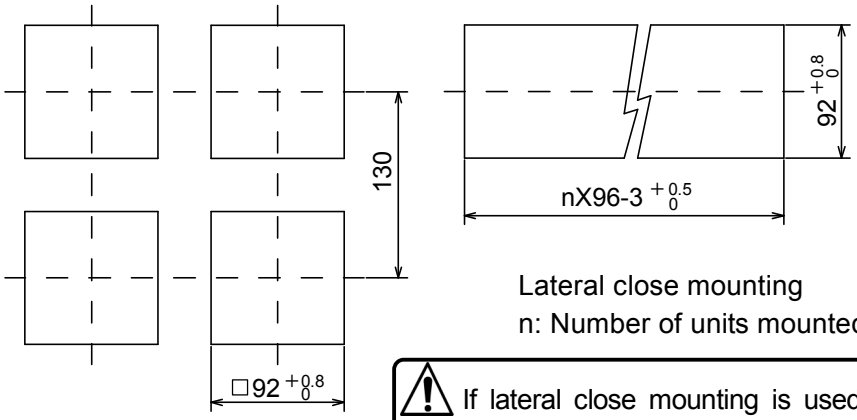
This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:
(1) A minimum of dust, and an absence of corrosive gases
(2) No flammable, explosive gases
(3) No mechanical vibrations or shocks
(4) No exposure to direct sunlight, an ambient temperature of 0 to 50℃ (32 to 122℉) that does not change rapidly, and no icing
(5) An ambient non-condensing humidity of 35 to 85%RH
(6) No large capacity electromagnetic switches or cables through which large current is flowing
(7) No water, oil or chemicals or where the vapors of these substances can come into direct contact with the controller
(8) Take note that ambient temperature of this unit must not exceed 50℃ (122℉) if mounted through the control panel. Otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

3.2 External dimensions and Panel cutout (Scale: mm)



(Fig. 3.2-1)



(Fig. 3.2-2)

Lateral close mounting
n: Number of units mounted

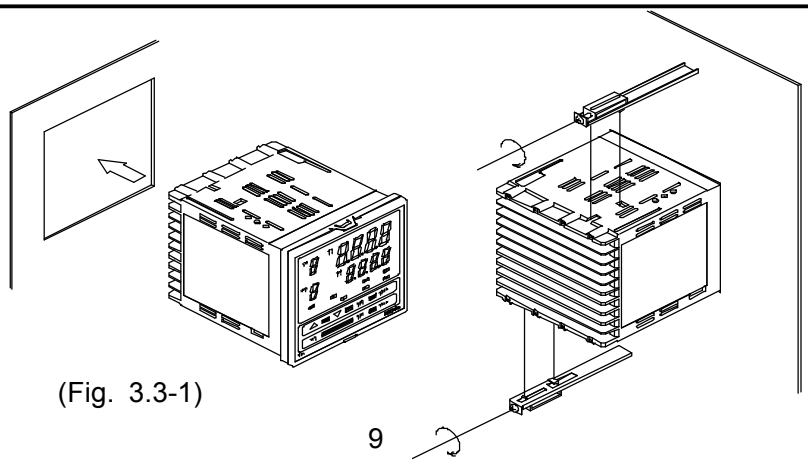
⚠ If lateral close mounting is used for the controller, IP66 specification (Drip-proof/Dust-proof) may be compromised, and all warranties will be invalidated.

3.3 Mounting

Mountable panel thickness is 1 to 8mm.
Insert the PCD-33A from the front of the control panel.
Slot the mounting bracket to the holes at the top and bottom of the case, and screw in place.

⚠ Notice

As the case is made of resin, do not use excessive force while screwing in the mounting bracket. The torque should be 0.12N•m.



(Fig. 3.3-1)

4. Wiring

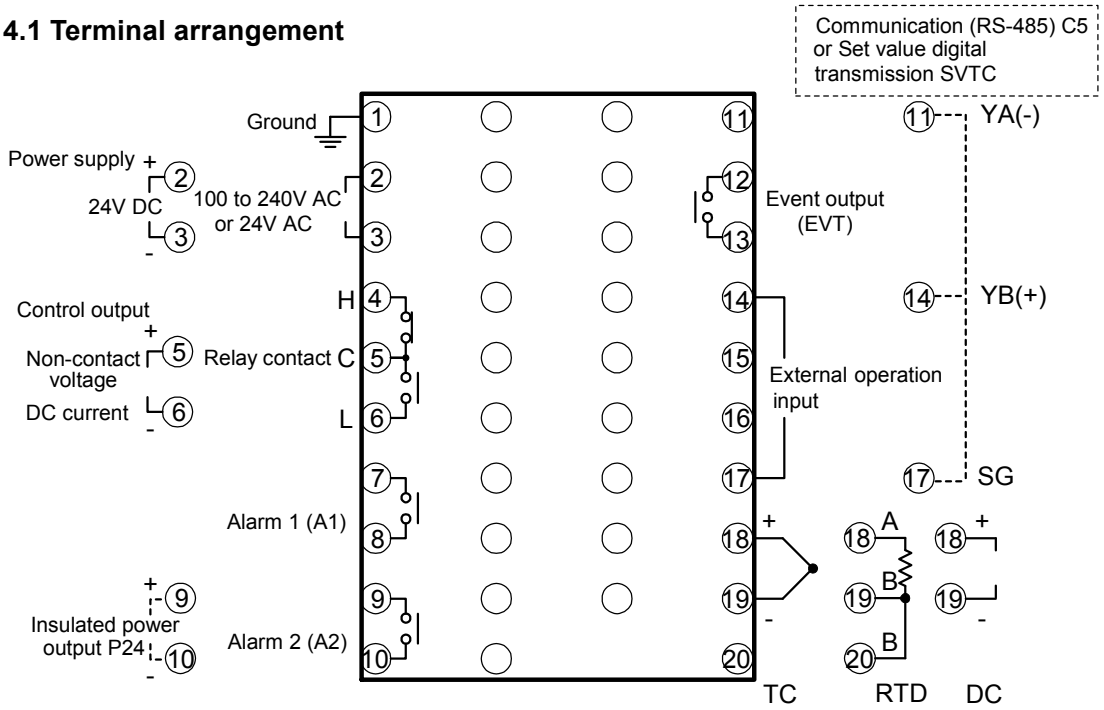
⚠ Warning

Turn the power supply to the instrument off before wiring or checking. Working on or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.
Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

⚠ Caution

- Do not leave wire remnants in the instrument, because they could cause a fire or malfunction.
- For the ground terminal of the PCD-33A, use 2mm^2 or more of thick wire. However, avoid grounding in conjunction with the power line.
- Use the solderless terminal with an insulation sleeve in which the M3 screw fits when wiring the PCD-33A terminals.
- The terminal block of the PCD-33A is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw (M3).
- Tighten the terminal screw (M3) using the specified torque. If the screw is tightened too hard, the screw or case may be damaged.
- Use a thermocouple, compensating lead wire and 3-wire system RTD according to the input specification of this controller.
- In the case of 24V DC for power source, do not confuse polarity.
- With the relay contact output type, externally use an auxiliary electromagnetic switch according to the capacity of the load to protect the built-in relay contact.
- When wiring, keep input wire (thermocouple, RTD, etc.) away from AC source and load wire.
- This controller has neither a built-in power switch nor a fuse. Therefore, it is necessary to install them in the circuit near the external controller. (Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may be burnt out.

4.1 Terminal arrangement



(Fig. 4.1-1)

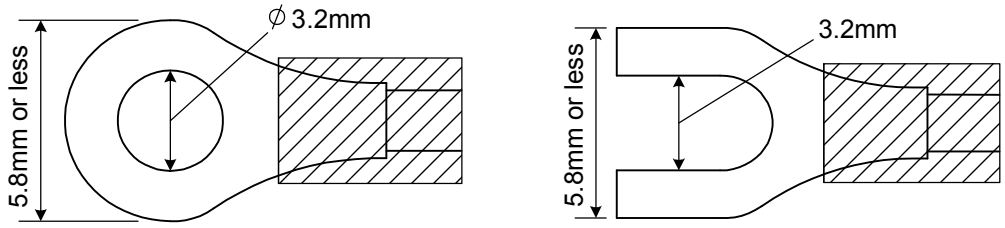
- For DC current input, 50Ω shunt resistor (sold separately) must be installed between input terminals.
- Dotted lines show options.
- If the C5 or SVTC option is added, external operation cannot be performed.
  The C5 and SVTC options cannot be added together.
  For details of options, see “10.2 Optional specifications” on p.54.

● Solderless terminal

Use a solderless terminal with an insulation sleeve in which the M3 screw fits as shown below.

The torque should be 0.63N•m.

Solderless terminal	Manufacturer	Model	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25Y-3	0.63N•m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Ring type	Nichifu Terminal Industries CO.,LTD.	TMEV1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	



(Fig. 4.1-2)

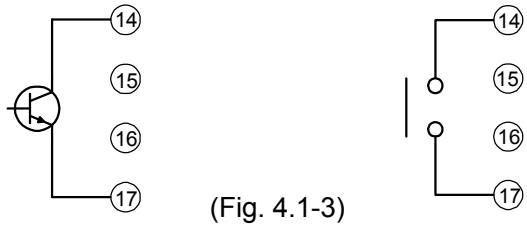
● **External operation function**

Program control run/stop can be performed externally. See (Fig. 4.1-3) and (Fig. 4.1-4).

• **External operation input terminals**

External operation comprises 2 input types as follows.

Open collector input　　Contact (pulse) input



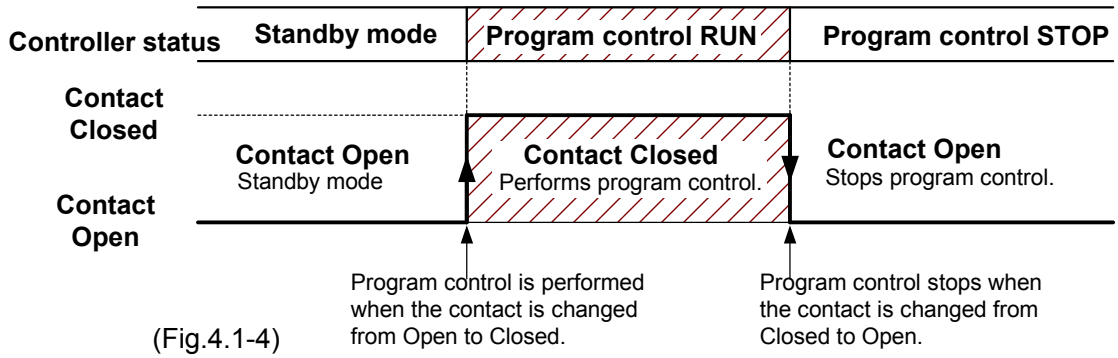
(Fig. 4.1-3)

• **Program control run**

As soon as terminals 14 and 17 change from Open to Closed, program control is performed.

• **Program control stop**

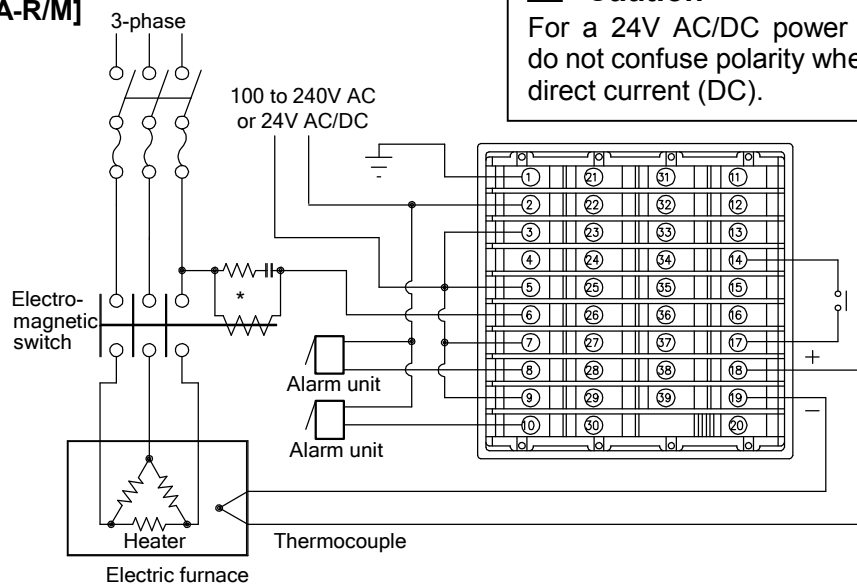
As soon as terminals 14 and 17 change from Closed to Open, program control stops.
If pattern end output is turned ON after program control ends, pattern end output stops by changing terminals 14 and 17 from Closed to Open.



(Fig.4.1-4)

4.2 Wiring examples

[PCD-33A-R/M]



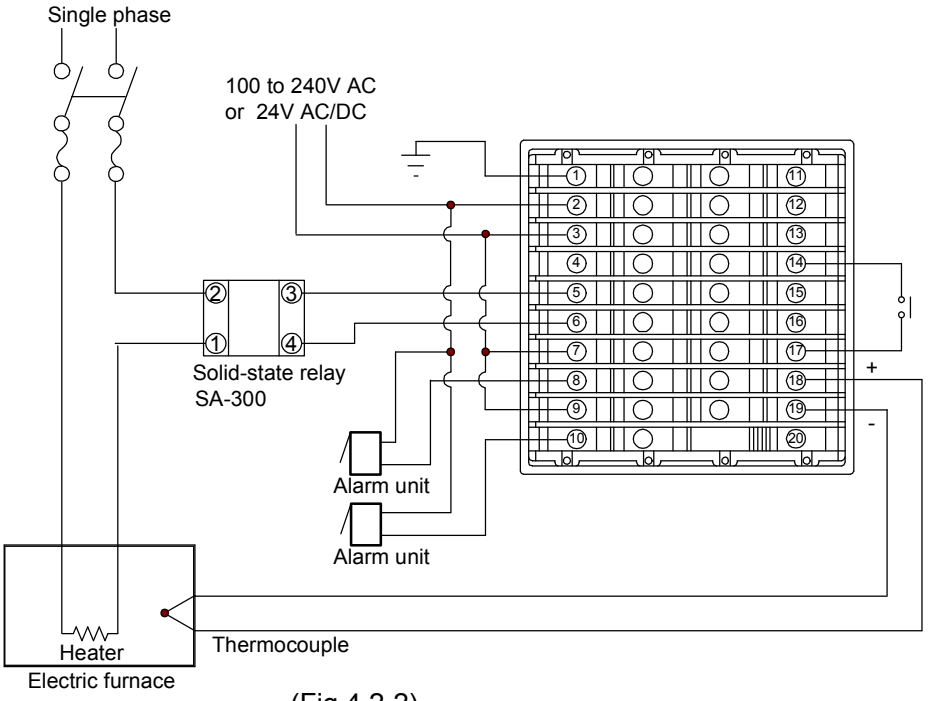
⚠ Caution

For a 24V AC/DC power source, do not confuse polarity when using direct current (DC).

* For the relay contact output type (PCD-33A-R/M), it is recommended that a surge absorber be installed between the electromagnetic switch coils to prevent the unit from harmful effects of unexpected high level noise.

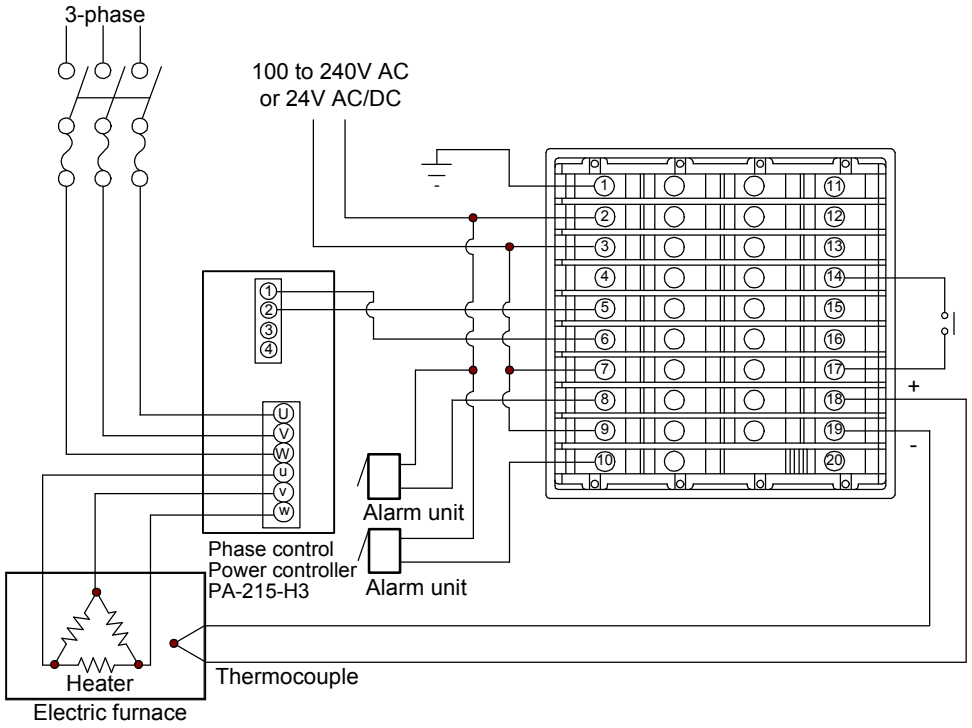
(Fig.4.2-1)

[PCD-33A-S/M]



(Fig.4.2-2)

[PCD-33A-A/M]



(Fig. 4.2-3)

5. Setup

5.1 Setup

Setup should occur before using this controller, to set the Input type, Program control start type, Alarm type, Control action, etc. according to the users' conditions.
If the users' specification is the same as the default value of the PCD-33A, it is not necessary to set up the controller. Proceed to "6. Operation" (p.21).
Set up the controller after connecting terminals 2 and 3 for the power supply to this instrument, referring to "4. Wiring" (p.10, 11).

Setup is conducted in Auxiliary function setting mode 2.
The setting items and default values in Auxiliary function setting mode 2 are shown below (Table 5.1-1).

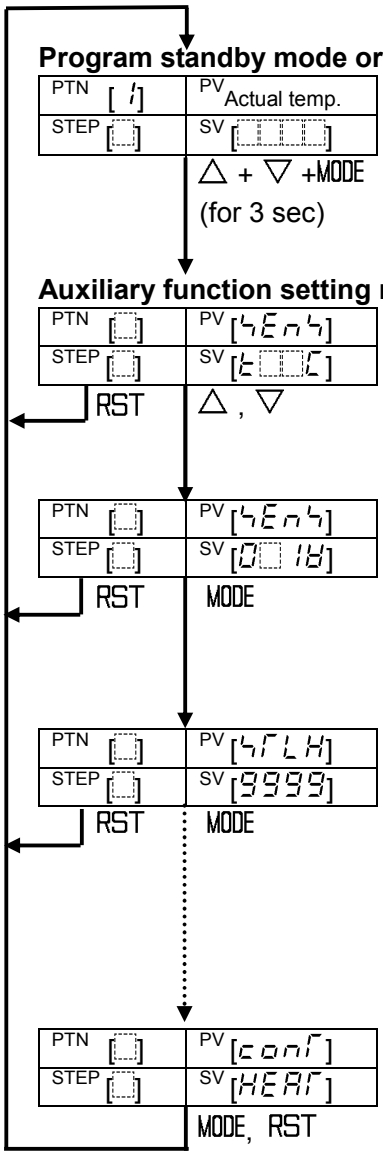
(Table 5.1-1)

	PV display	Setting/Selection item	Default value
(1)	SEnS	**Input type** Selects a sensor type and unit ℃/℉.	Thermocouple K -200 to 1370℃
(2)	SrLH	**Scaling high limit** Sets the scaling high limit value.	9999
(3)	SrLL	**Scaling low limit** Sets the scaling low limit value.	-1999
(4)	dP□□	**Decimal point place** Selects a decimal point place.	No decimal point
(5)	FILT	**PV filter time constant** Sets the PV filter time constant.	0.0 seconds
(6)	t_St	**Step time unit** Selects the step time unit.	Hour:Minute
(7)	St_SV	**Step SV for control start** Sets step SV when program control starts.	0℃
(8)	St_St	**Program control start type** Selects the program control start type.	PV start
(9)	oLH□	**OUT high limit** Sets OUT (control output) high limit.	100%
(10)	oLL□	**OUT low limit** Sets OUT (control output) low limit.	0%
(11)	HYS□	**OUT ON/OFF hysteresis** Sets OUT (control output) ON/OFF hysteresis.	1.0℃
(12)	AL 1F	**Alarm 1 (A1) type** Selects Alarm 1 (A1) type.	No alarm action
(13)	AL2F	**Alarm 2 (A2) type** Selects Alarm 2 (A2) type.	No alarm action
(14)	A1LC	**Alarm 1 (A1) Energized/De-energized** Selects Alarm 1 (A1) Energized/De-energized.	Energized
(15)	A2LC	**Alarm 2 (A2) Energized/De-energized** Selects Alarm 2 (A2) Energized/De-energized.	Energized
(16)	A1HY	**Alarm 1 (A1) hysteresis** Sets Alarm 1 (A1) hysteresis.	1.0℃
(17)	A2HY	**Alarm 2 (A2) hysteresis** Sets Alarm 2 (A2) hysteresis.	1.0℃
(18)	A1dY	**Alarm 1 (A1) action delay timer** Sets Alarm 1 (A1) action delay timer.	0 seconds

(19)	A2dY	**Alarm 2 (A2) action delay timer** Sets Alarm 2 (A2) action delay timer.	0 seconds
(20)	EVTL	**Event output function** Selects an Event output type.	Time signal output
(21)	PETn	**Pattern end output time** Sets pattern end output time.	0sec(Continuous output)
(22)	conT	**Direct/Reverse control action** Selects Direct(Cooling) or Reverse(Heating) control action.	Reverse (Heating) control

5.2 Basic operation for setup

The following shows how to enter and set Auxiliary function setting mode 2.
To enter Auxiliary function setting mode 2, press the MODE Key for 3 seconds while holding down the △ and ▽ keys in the Program standby mode or in the Program control run mode.
Set or select values with the △ or ▽ key.
To register the values, use the MODE or RST Key.



Press the MODE Key for 3 seconds while holding down the △ and ▽ keys.
The unit enters Auxiliary function setting mode 2, and Input type selection mode appears.

Input type
Select a sensor type that matches the users' with the △ or ▽ key.
• Default: K C (K, -200 to 1370℃)

DC voltage input 0 1V (0 to 1V DC) has been selected in this example.
Press the MODE Key. The input type will be registered, and the Scaling high limit setting item will appear. If any other input type except DC input is selected, the PV filter time constant setting item will appear.

Scaling high limit
Set a value with the △ or ▽ key, and register it with the MODE Key.

Set other items in the same way according to the users' conditions.

If the MODE Key is pressed several times or if the RST Key is pressed, the controller reverts to the Program standby mode.

If the RST Key is pressed, the controller reverts to the Program standby mode from any mode.

5.3 Setting items in Auxiliary function setting mode 2

(1) **Input type**

Selects a sensor type and temperature unit.

When changing the input from DC voltage to other inputs, remove the sensor connected to this controller, then change the input. If the input is changed while the sensor is connected, the input circuit may break.

Set the same sensor type as the users'.

Selecting item: Refer to (Table 5.3-1) below.

Default value: tC (K, -200 to 1370℃)

(Table 5.3-1)

Input		Input range	Character	Input range	Character
Thermo-couple	K	-200 to 1370 ℃	tC	-320 to 2500 ℉	tF
		-199.9 to 400.0 ℃	t.C	-199.9 to 750.0 ℉	t.F
	J	-200 to 1000 ℃	JC	-320 to 1800 ℉	JF
	R	0 to 1760 ℃	rC	0 to 3200 ℉	rF
	S	0 to 1760 ℃	SC	0 to 3200 ℉	SF
	B	0 to 1820 ℃	bC	0 to 3300 ℉	bF
	E	-200 to 800 ℃	EC	-320 to 1500 ℉	EF
	T	-199.9 to 400.0 ℃	t.C	-199.9 to 750.0 ℉	t.F
	N	-200 to 1300 ℃	nC	-320 to 2300 ℉	nF
	PL-Ⅱ	0 to 1390 ℃	PLC	0 to 2500 ℉	PLF
	C(W/Re5-26)	0 to 2315 ℃	CC	0 to 4200 ℉	CF
RTD	Pt100	-199.9 to 850.0 ℃	P.C	-199.9 to 999.9 ℉	P.F
	JPt100	-199.9 to 500.0 ℃	JP.C	-199.9 to 900.0 ℉	JP.F
	Pt100	-200 to 850 ℃	PC	-300 to 1500 ℉	PF
	JPt100	-200 to 500 ℃	JPC	-300 to 900 ℉	JPF
DC current	4 to 20mA	-1999 to 9999			420A
	0 to 20mA	-1999 to 9999			020A
DC voltage	0 to 1V	-1999 to 9999			0 1V
	0 to 5V	-1999 to 9999			0 5V
	1 to 5V	-1999 to 9999			1 5V
	0 to 10V	-1999 to 9999			0 10V

(2) **Scaling high limit**

Available only for DC current and voltage input

- Setting range: Scaling low limit value to input range high limit value
- Default value: 9999

(3) **Scaling low limit**

Available only for DC current and voltage input

- Setting range: Input range low limit value to scaling high limit value
- Default value: -1999

(4) **Decimal point place**

For DC current and voltage input, the input indication can be freely set.

(e.g.) If DC voltage input 0 to 1V DC is set, 0V corresponds to –1999, and 1V corresponds to 9999. To indicate 0V as 0.0 and 1V as 100.0, Scaling high limit is1000, Scaling low limit is 0, and select the decimal point place as "1 digit after the decimal point (0.0)".

• Selecting item: □□□0 No decimal point
□□0.0 1 digit after the decimal point
□0.00 2-digit after the decimal point
0.000 3-digit after the decimal point
• Default value: □□□0 (No decimal point)

(5) FILT: **PV filter time constant**

Sets the PV filter time constant.
This reduces input fluctuation caused by noise.
If the input changes in a step, set the time that reaches 63% of the step.
However, if the set value is set too high, it affects control result due to delay of response.
• Setting range: 0.0 to 10.0 seconds
• Default value: 0.0 seconds

(6) ṁ_t□ **Step time unit**

Selects the unit of program progression time.
• Selecting item: ṁi m□ Hour:Minute
tEc□ Minute:Second
• Default value: ṁi m□ Hour:Minute

(7) t_tB **Step SV for control start**

Sets the step SV when program control starts.
Program control starts with the step SV regardless of the program control start type (SV start or PV start).
• Setting range: SV low limit to SV high limit
• Default value: 0℃

(8) t_tL **Program control start type**

Selects a program control start type.
PV start: When the program control starts, the step SV and time are advanced to the PV and the control starts. However, if the value set during "(7) Step SV for control start" is larger than the PV, PV start is cancelled, and the control starts from the value which has been set during "(7) Step SV for control start.
SV start: When the program control starts, the control starts from the value which has been set during "(7) Step SV for control start".
• Setting range: PB□□: PV start
tB□□: SV start
• Default value: PV start

(9) oLH□ **OUT high limit**

Sets OUT (control output) high limit value.
Not available for ON/OFF control.
• Setting range: OUT low limit value to 100%
• Default value: 100% (DC current output type: OUT low limit value to 105%)

(10) oLL□ **OUT low limit**

Sets OUT (control output) low limit value.
Not available for ON/OFF control.
• Setting range: 0% to OUT high limit value
• Default value: 0% (DC current output type: -5% to OUT high limit value)

(11) HYt□ **OUT ON/OFF hysteresis**

Sets OUT (control output) ON/OFF hysteresis.
Available only for ON/OFF control.
• Setting range: 0.1 to 100.0℃ (℉)
DC input: 1 to 1000 (The placement of the decimal point follows the selection.)
• Default value: 1.0℃

(12) AL 1F **Alarm 1 (A1) type**

Selects Alarm 1 (A1) type, referring to 8.5 Alarm 1 (A1) action (pages 48, 49).

Note: If an alarm type is changed, the alarm set value becomes 0 (0.0).

• Selecting item: ---- No alarm action

H□□□ High limit alarm

L□□□ Low limit alarm

HL□□ High and Low limits alarm

in□d□ High and Low limit range alarm

R5□□ Process High alarm

rR5□ Process Low alarm

H□□□ High limit alarm with standby

L□□□ Low limit alarm with standby

HL□□ High and Low limits alarm with standby

• Default value: ---- No alarm action

(13) AL2F **Alarm 2 (A2) type**

Selects Alarm 2 (A2) type, referring to 8.5 Alarm 2 (A2) action (pages 48, 49).

Note: If an alarm type is changed, the alarm set value becomes 0 (0.0).

The selecting items and default value are the same as those of Alarm 1 (A1) type.

Not available if P24 (option) is added.

(14) A1LN **Alarm 1 (A1) Energized/De-energized**

Selects Alarm 1 (A1) Energized/De-energized.

Not available if No alarm action is selected during Alarm 1 (A1) type selection.

• Selecting item: nonL Energized, rEV5 De-energized

• Default value: nonL Energized

(15) A2LN **Alarm 2 (A2) Energized/De-energized**

Selects Alarm 2 (A2) Energized/De-energized.

Not available if No alarm action is selected during Alarm 1 (A1) type selection.

Not available if P24 (option) is added.

The selecting item and default value are the same as those of Alarm 1 (A1) Energized/De-energized selection.

(16) A1HY **Alarm 1 (A1) hysteresis**

Sets Alarm 1 (A1) hysteresis.

Not available if No alarm action is selected during Alarm 1 (A1) type selection.

• Setting range: 0.1 to 100.0℃ (℉)

DC input: 1 to 1000 (The placement of the decimal point follows the selection.)

• Default value: 1.0℃

(17) A2HY **Alarm 2 (A2) hysteresis**

Sets Alarm 2 (A2) hysteresis.

Not available if No alarm action is selected during Alarm 1 (A1) type selection.

Not available if P24 (option) is added.

The setting range and default value are the same as those of Alarm 1 (A1) hysteresis setting.

(18) A1dY **Alarm 1 (A1) action delay timer**

Sets Alarm 1 (A1) action delay timer.

Not available if No alarm action is selected during Alarm 1 (A1) type selection.

• Setting range: 0 to 9999 seconds

• Default value: 0 seconds

(19) A2dY **Alarm 2 (A2) action delay timer**

Sets Alarm 2 (A2) action delay timer.

Not available if No alarm action is selected during Alarm 2 (A2) type selection.

Not available if P24 (option) is added.

The setting range and default value are the same as those of Alarm 1 (A1) action delay timer setting.

(20) EVTL **Event output function**

Selects an Event output type from Time signal output, Pattern end output and Run output.

When Event output is turned ON, EVT indicator is turned on, and terminals 12 and 13 are used for the Event output.

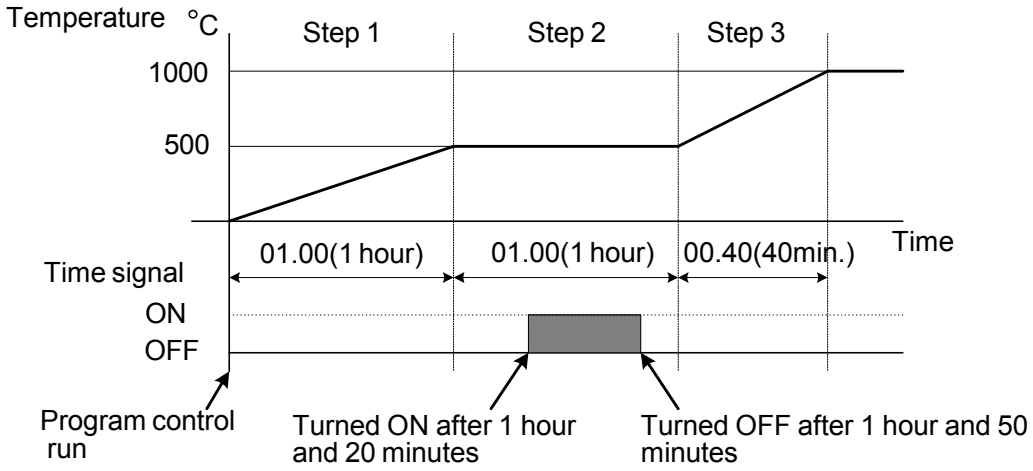
- Selecting item: TM□□ Time signal output
  P.End Pattern end output
  rUn□ Run output.
- Default value: TM□□ Time signal output

Event output

[Time signal output] (Fig. 5.3-1)

Sets the amount of time for Time signal output OFF time and ON time within 1 pattern time. Time signal output ON time follows Time signal output OFF time after the program control starts.

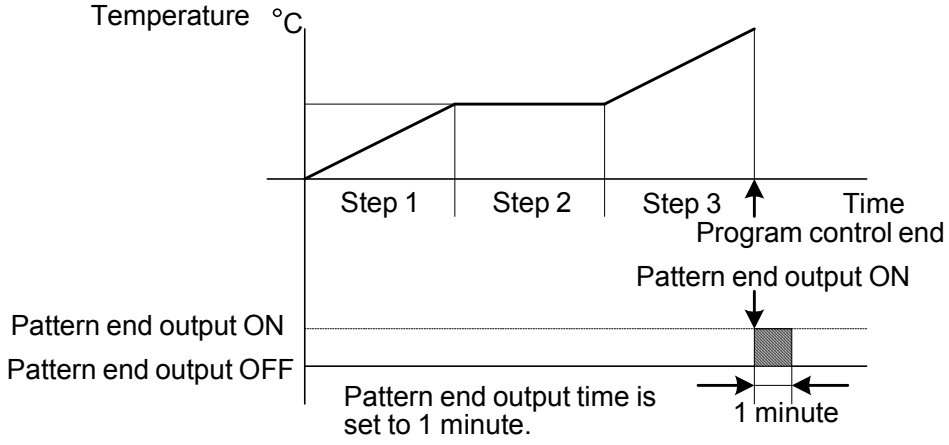
When Time signal output ON time has elapsed, Time signal output is turned OFF.



Setting: Time signal output OFF time: 1 hour 20 minutes
Time signal output ON time: 30 minutes
(Fig. 5.3-1)

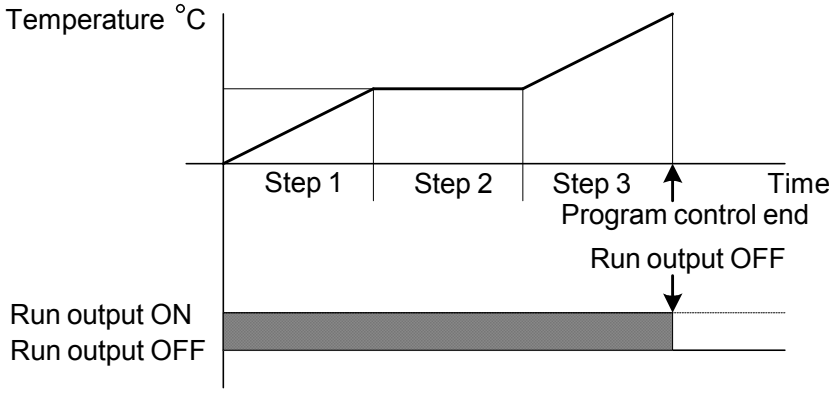
[Pattern end output] (Fig. 5.3-2)

After the program control ends, pattern end output is turned ON for the time set during the Pattern end output time setting.



(Fig. 5.3-2)

[Run output] (Fig. 5.3-3)
This is outputted during the program control. (Fig. 5.3-3)



(Fig. 5.3-3)

(21) PEr n **Pattern end output time**
Sets pattern end output time after pattern end output has been selected during Event output function selection.
When 0 seconds are set, the output remains ON until the STOP Key is pressed.
Available only when pattern end output is selected during Event output function selection.
• Setting range: 0 to 9999 seconds
• Default value: 0 seconds

(22) conF **Direct/Reverse control action**
Selects the Direct (Cooling) or Reverse (Heating) control action.

Direct control action
When PV (process variable) is higher than SV (desired value), the control output (OUT) is turned ON. This is a direct control action.
This is used for cooling control for devices such as refrigerators.

Reverse control action
When PV (process variable) is lower than SV (desired value), the control output (OUT) is turned ON. This is a reverse control action.
This is used for heating control for devices such as electric furnaces.
• Selecting item: HEAT Reverse (Heating) control action
cooL Direct (cooling) control action
• Default value: HEAT Reverse (Heating) control action

6. Operation

● **Key operation for setup**

PTN Key : Selects a program pattern number.

△ , ▽ key : Increases or decreases the numeric value or switches the selecting item.

MODE, RST Key : Registers the set value (numeric value) or selected item.
By pressing the RST Key, the controller reverts to the Program standby mode or Program control run mode. This key is very convenient as the user can revert to the Program standby mode or Program control run mode from any setting mode.

● **Key operation on the Operation flowchart**

MODE : Press the MODE Key.

MODE(3 sec) : Press the MODE Key for 3 seconds.

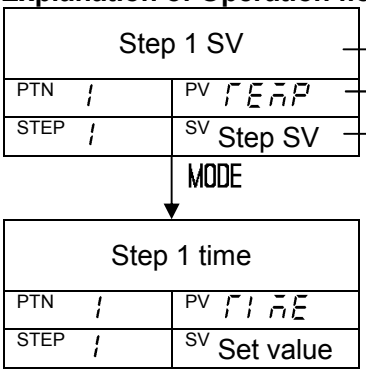
△ +MODE : Press the MODE Key while holding down the △ key.

△ + ▽ (3 sec) : Press the △ and ▽ keys for 3 seconds.

▽ +MODE(3 sec) : Press the MODE Key for 3 seconds while holding down the ▽ key.

△ + ▽ +MODE(3 sec) : Press the MODE Key for 3 seconds while holding down the △ and ▽ keys.

● **Explanation of Operation flowchart**



→ Setting item

→ PTN and PV display

→ STEP and SV display

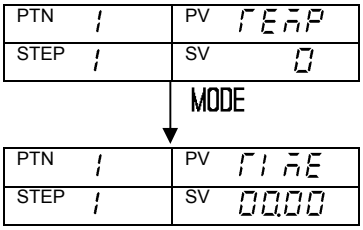
A space ⬚ on the display means nothing is indicated.

(e.g. Pattern 1 is set here.)
If the MODE Key is pressed at Step 1 SV setting, the set value is saved, and the setting item proceeds to the [Step 1 time setting].

● **Explanation of Operation**

For the explanation of each setting item (pages 24 to 33), current status of each display is indicated with diagrams on the left side, and its item name and operation method are described on the right side.

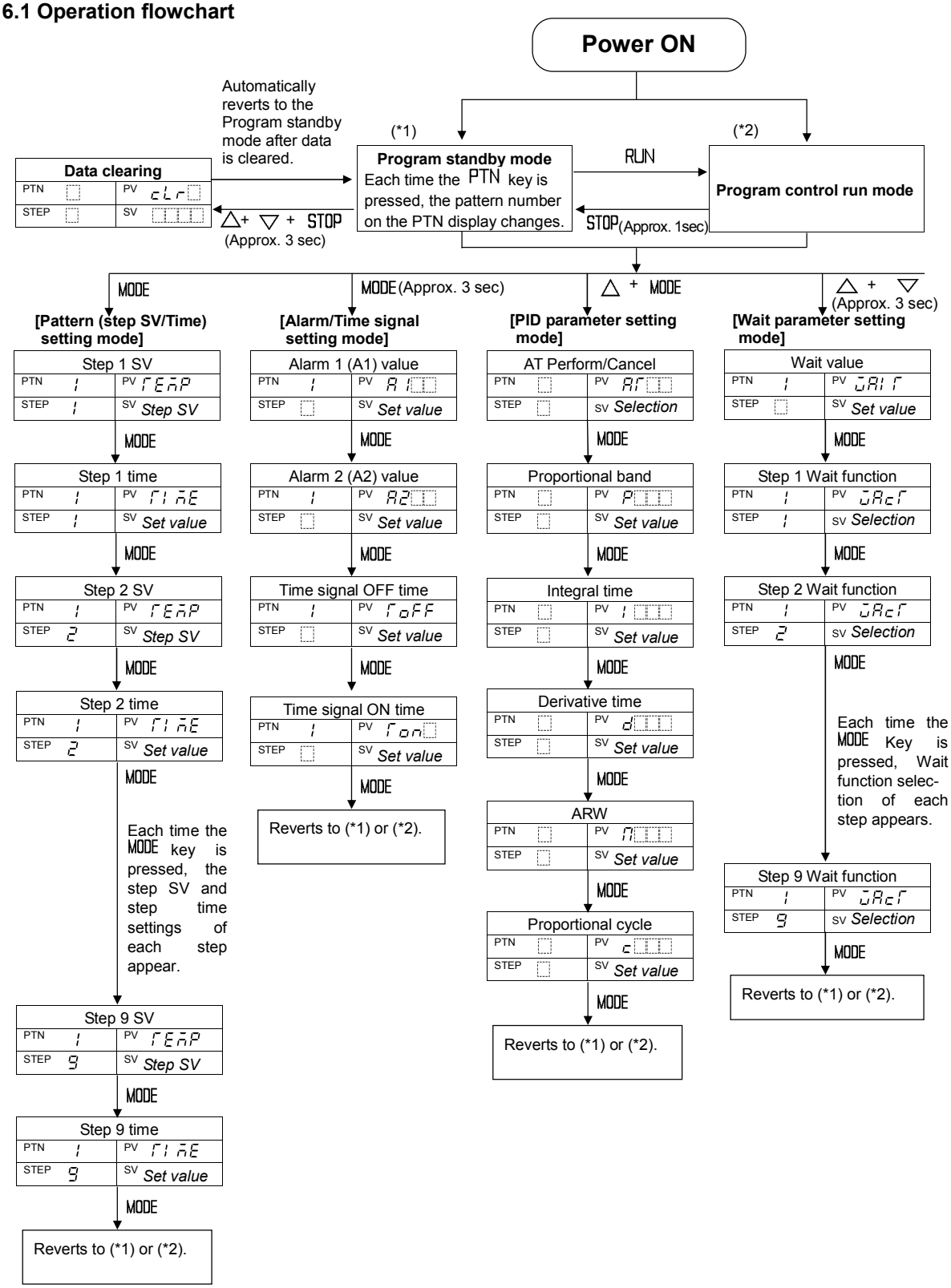
By pressing the MODE Key, the set value is saved, and the setting item proceeds to the next one.



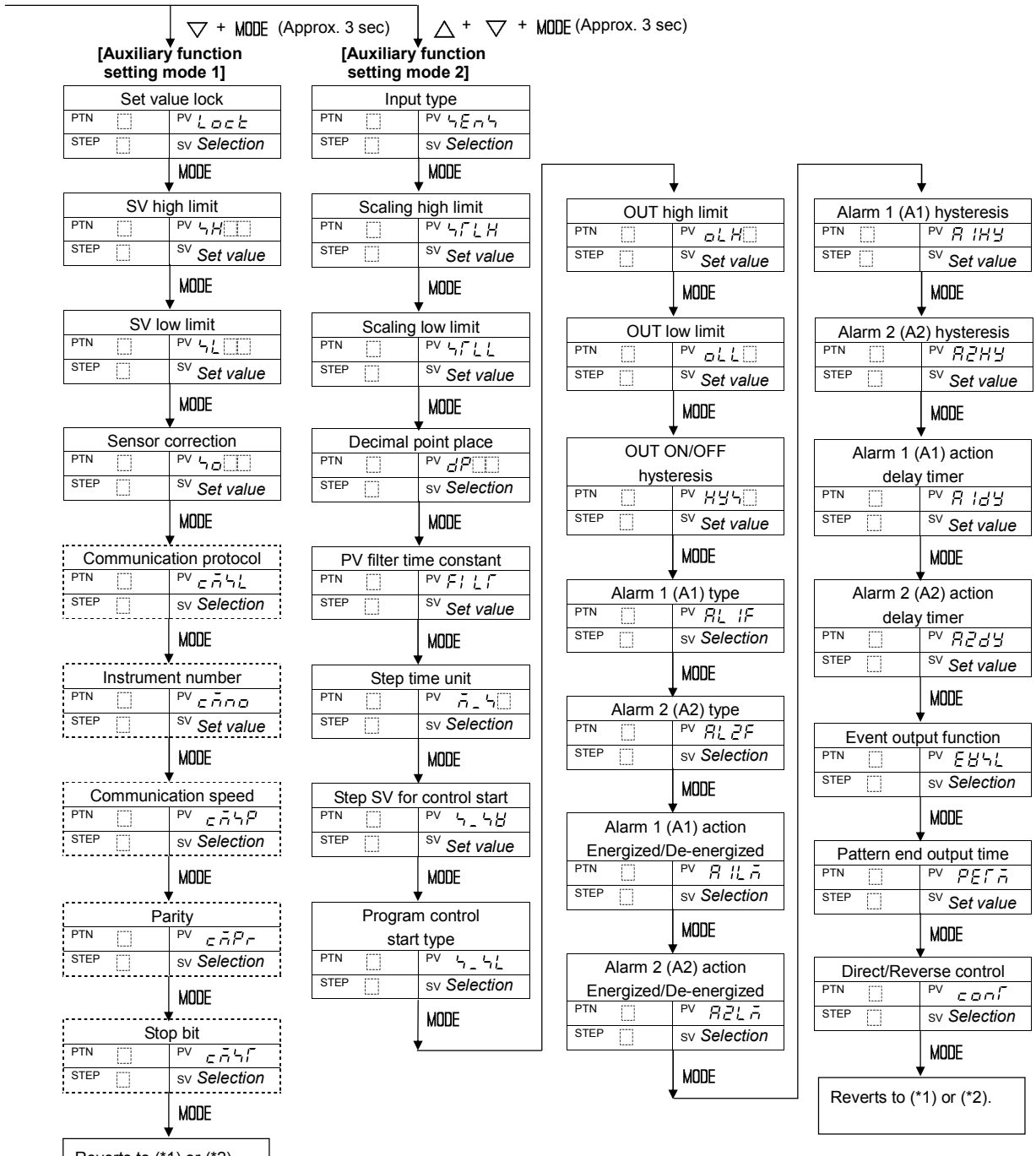
Step 1 SV setting

Step 1 time setting

6.1 Operation flowchart



• BY pressing the RST Key, the controller reverts to (*1) or (*2) from any mode.
• The setting items with dotted lines are optional, and they appear only when the options are added.



6.2 Operation

(1) Turn the power supply to the controller ON.

The sensor input characters and temperature unit are indicated on the PV display, and the input range high limit value is indicated on the SV display for approx. 3 seconds after the power is turned ON. See (Table 6.2-1). For DC input, Scaling high limit value is indicated on the SV display for approx. 3 seconds after the power is turned ON.

During this time, all outputs and the LED indicators are in OFF status.
After that, the controller switches to Program standby mode.

(Table 6.2-1)

Input	Scale range	Character	Scale range	Character
K	-200 to 1370℃		-320 to 2500℉	
	-199.9 to 400.0℃		-199.9 to 750.0℉	
J	-200 to 1000℃		-320 to 1800℉	
R	0 to 1760℃		0 to 3200℉	
S	0 to 1760℃		0 to 3200℉	
B	0 to 1820℃		0 to 3300℉	
E	-200 to 800℃		-320 to 1500℉	
T	-199.9 to 400.0℃		-199.9 to 750.0℉	
N	-200 to 1300℃		-320 to 2300℉	
PL-Ⅱ	0 to 1390℃		0 to 2500℉	
C(W/Re5-26)	0 to 2315℃		0 to 4200℉	
Pt100	-199.9 to 850.0℃		-199.9 to 999.9℉	
JPt100	-199.9 to 500.0℃		-199.9 to 900.0℉	
Pt100	-200 to 850℃		-300 to 1500℉	
JPt100	-200 to 500℃		-300 to 900℉	
4 to 20mA DC	-1999 to 9999			
0 to 20mA DC	-1999 to 9999			
0 to 1V DC	-1999 to 9999			
0 to 5V DC	-1999 to 9999			
1 to 5V DC	-1999 to 9999			
0 to 10V DC	-1999 to 9999			

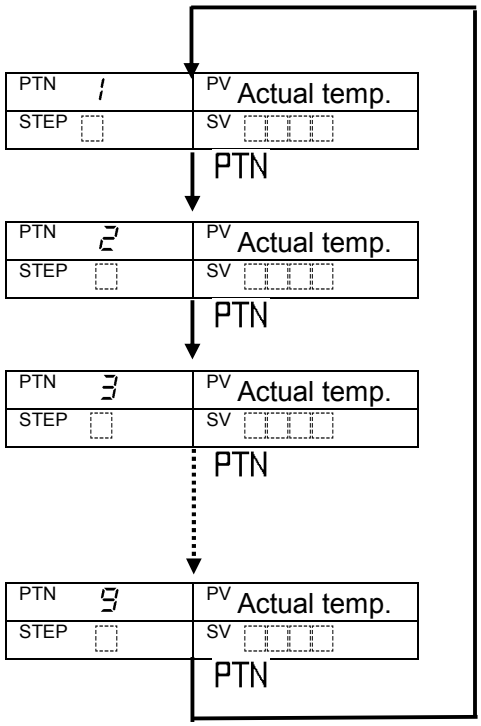
(2) Program standby mode

Control is not performed during this mode.
In this mode, the currently selected pattern number is indicated on the PTN display, and actual temperature is indicated on the PV display.

(3) Program pattern number selection

Select a program pattern number before initiating program settings.
The program pattern number can only be selected during the Program standby mode. It cannot be selected during program control run.

By pressing the PTN Key, select a program pattern number (1 to 9).
Each time the PTN Key is pressed, the program pattern number changes according to the following.
1 → 2 → 3 → 4 …….. 9 → 1



Program pattern 1 is selected.

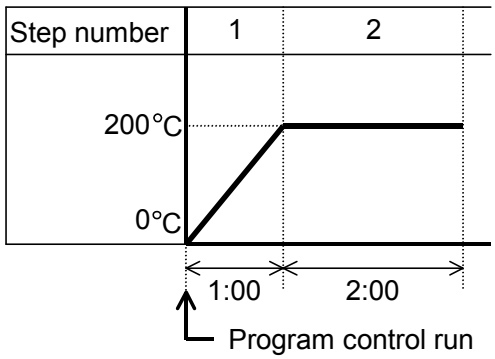
Program pattern 2 is selected.

Program pattern 3 is selected.

Program pattern 9 is selected.

(4) Pattern (step SV/Time) setting mode

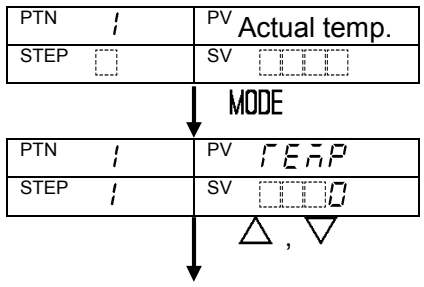
This mode is available for the currently selected program pattern number.
The following is an example of program pattern setting and its procedures.



This program pattern shows that the temperature rises to 200℃ for 1 hour, and stays at 200℃ for 2 hours.
In this case, Step 1 SV is 200℃ and Step 1 time is 1 hour.

(Fig.6.2-1)

[Program standby mode or Program control run mode]

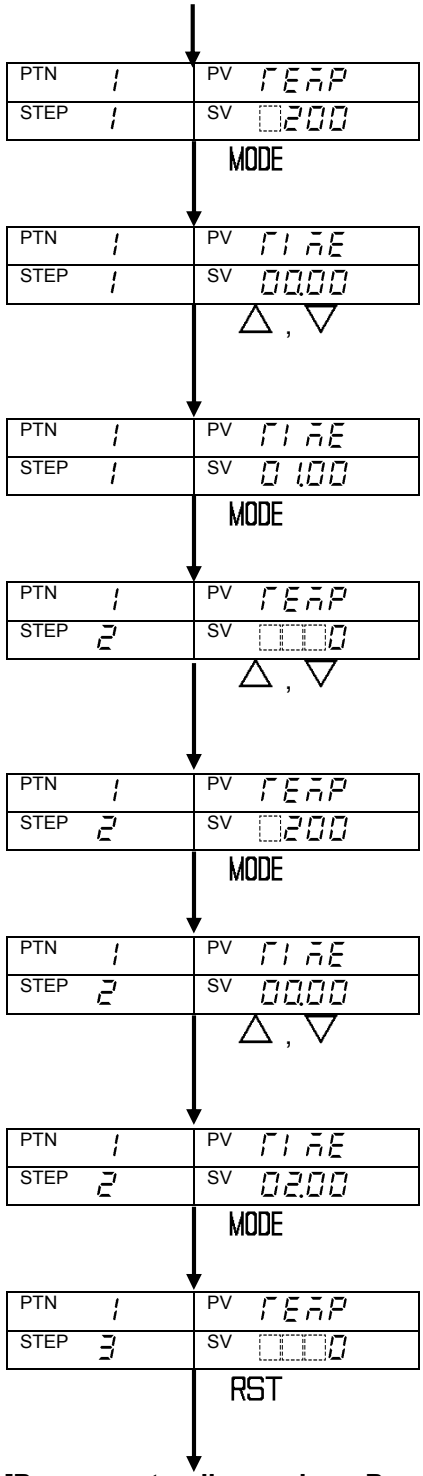


Press the MODE Key.
Step 1 SV setting mode appears.

Step 1 SV

Set the step SV to 200℃ using △ or ▽ key.

- Setting range: SV low limit to SV high limit
- Default value: 0℃



Press the MODE Key.
Step 1 SV is registered, and
Step 1 time setting mode appears.

Step 1 time
Set the step time to (1:00) using △ or ▽ key.
• Setting range: - - - - to 00:00 to 99:59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Press the MODE Key.
Step 1 time is registered, and
Step 2 SV setting mode appears.

Step 2 SV
Set the step SV to 200℃ using △ or ▽ key.
• Setting range: SV low limit to SV high limit
• Default value: 0℃

Press the MODE Key.
Step 2 SV is registered, and
Step 2 time setting mode appears.

Step 2 time
Set the step time to (2:00) using △ or ▽ key.
• Setting range: - - - - to 00:00 to 99:59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Press the MODE Key.
Step 2 time is registered, and
Step 3 SV setting mode appears.

Step 3 SV
Step 3 and after can be set in the same way as the above.
Press RST Key to return to Program standby mode.

[Program standby mode or Program control run mode]
The program pattern setting (example) has been completed.

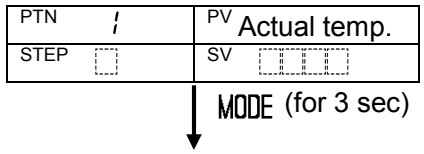
(5) Alarm/Time signal setting mode

Alarm/Time signal setting mode is available for the currently selected program pattern number.

Settings are available only for the pattern which is now running during program control.

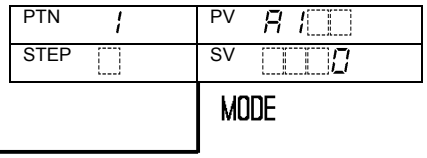
Note: To go to the Alarm/Time signal setting mode, select an alarm type except for No alarm action from Alarm 1 (A1) and Alarm 2 (A2) type selection in "5. Setup", or select Time signal output from Event output function selection.
If either of the above is not selected, the controller cannot proceed to the Alarm/Time signal setting mode.

[Program standby mode or Program control run mode]



Press the MODE Key for 3 seconds.
Alarm/Time signal setting mode is selected, and Pattern 1 Alarm 1 (A1) value setting item appears.

[Alarm/Time signal setting mode]

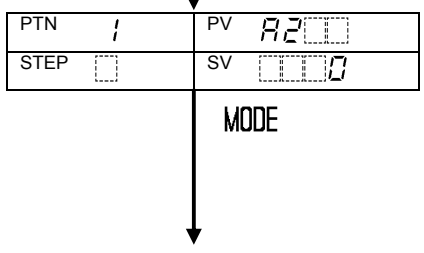


Pattern 1 Alarm 1 (A1) value
Setting the value to 0 or 0.0 disables the function (except process high, low alarm).
Not available if No alarm action is selected during Alarm 1 (A1) type selection.
• Setting range: Refer to (Table 6.2-2) below.
• Default value: 0℃

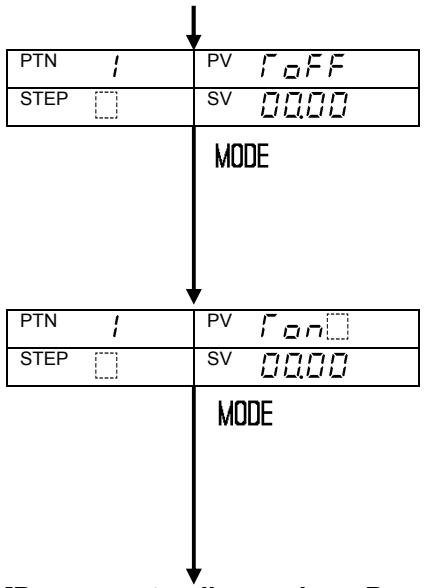
● **Alarm 1 (A1), Alarm 2 (A2) setting range (Table 6.2-2)**

Alarm type	Setting range
High limit alarm	-Input span to Input span℃ (℉)
Low limit alarm	-Input span to Input span℃ (℉)
High/Low limits alarm	0 to Input span℃ (℉)
High/Low limit range alarm	0 to Input span℃ (℉)
Process high alarm	Input range low limit to Input range high limit℃ (℉)
Process low alarm	Input range low limit to Input range high limit℃ (℉)
High limit alarm with standby	-Input span to Input span℃ (℉)
Low limit alarm with standby	-Input span to Input span℃ (℉)
H/L limits alarm w/standby	0 to Input span℃ (℉)

• For input with a decimal point, the negative low limit value is -199.9 and the positive high limit value is 999.9.
• For DC input, the input span is the same as the scaling span, and input range low (or high) limit value is the same as the scaling low (or high) limit value.



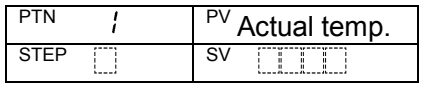
Pattern 1 Alarm 2 (A2) value
Setting the value to 0 or 0.0 disables the function (except process high, low alarm).
Not available if No alarm action is selected during Alarm 2 (A2) type selection, or if P24 (option) is added.
• Setting range: Refer to (Table 6.2-2).
• Default value: 0℃



Pattern 1 Time signal output OFF time
Sets Time signal output OFF time after running program control.
Available only when Time signal output is selected during Event output function selection.
• Setting range: 00:00 to 99.59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

Pattern 1 Time signal output ON time
Sets Time signal output ON time following the Time signal output OFF time.
Available only when Time signal output is selected during Event output function selection.
• Setting range: 00:00 to 99.59
(Hour:Minute or Minute:Second)
• Default value: 00:00 (Hour:Minute)

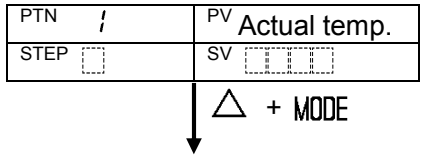
[Program standby mode or Program control run mode]



(6) PID parameter setting mode

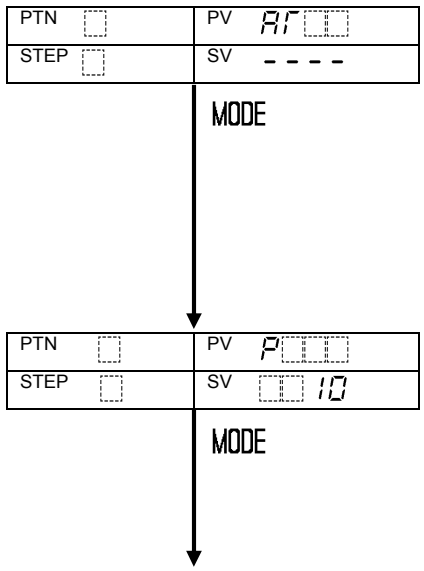
Sets parameters and items necessary for the control such as AT Perform/Cancel, P, I, D and Proportional cycle, etc.
Settings in this mode are common to all program pattern numbers.

[Program standby mode or Program control run mode]



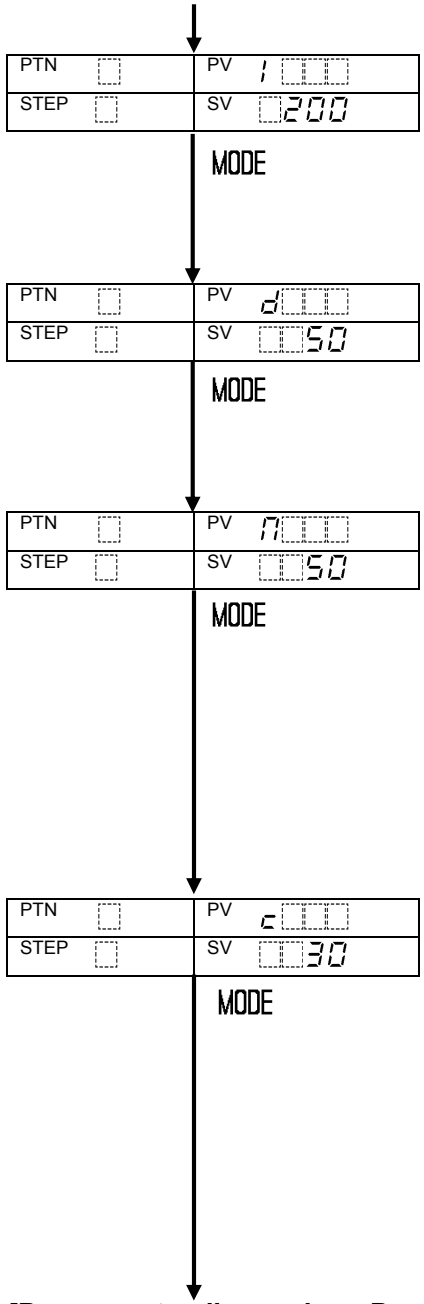
Press the MODE Key while holding down the △ key.
PID parameter setting mode appears, and AT Perform/Cancel is indicated.

[PID parameter setting mode]



AT Perform/Cancel
Selects Auto-tuning Perform or Cancel.
Available only during program control run and during PID control.
Not available for Program standby mode.
• Setting range: ---- AT Cancel
AT AT Perform
• Default value: ---- AT Cancel

Proportional band
Sets the proportional band for the control output.
ON/OFF control when set to 0 or 0.0.
• Setting range: 0 to 1000℃ (0 to 2000℉)
For the input with a decimal point,
0.0 to 999.9℃ (0 to 999.9℉)
For DC input, 0.0 to 100.0%
• Default value: 10℃



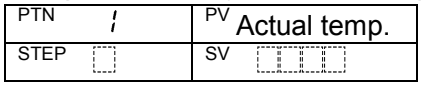
Integral time
Sets the integral time.
Off when set to 0.
Not available for ON/OFF control.
• Setting range: 0 to 1000 seconds
• Default value: 200 seconds

Derivative time
Sets the derivative time.
Off when set to 0.
Not available for ON/OFF control.
• Setting range: 0 to 300 seconds
• Default value: 50 seconds

ARW (Anti-reset windup)
Sets the ARW.
Available only for PID control.
This prevents overshoot caused by the integral action.
ARW is automatically set by performing auto-tuning. When setting manually, set ARW to the closest MV (manipulated variable) when the control is stabilized.
• Setting range: 0 to 100%
• Default value: 50%

Proportional cycle
Sets the proportional cycle.
Not available for ON/OFF control or DC current output type.
With the relay contact output type, if the proportional cycle time is decreased, the frequency of relay action increases and the life of the relay contact is shortened.
• Setting range: 1 to 120 seconds
• Default value: 30 sec for relay contact output,
3 sec for non-contact voltage output type

[Program standby mode or Program control run mode]



(7) Wait parameter setting mode

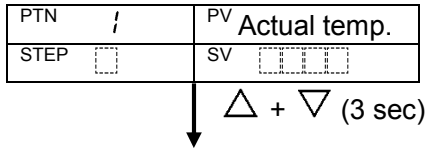
This function prevents the step from proceeding to the next one until PV enters the range of step SV±Wait value regardless of the step time.

Wait function Used/Not used can be set to each step.

Wait parameter setting mode is available for the currently selected program pattern number.

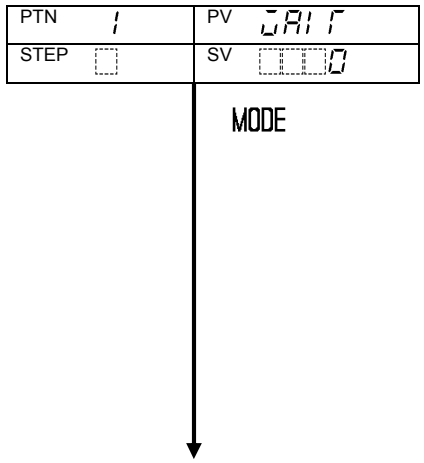
Settings are available only for the pattern which is now running during program control.

[Program standby mode or Program control run mode]

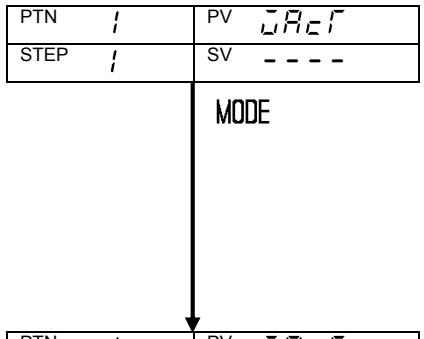


Press the ▽ key for 3 seconds while holding down the △ key.
Wait parameter setting mode appears, and Wait value setting item is indicated.

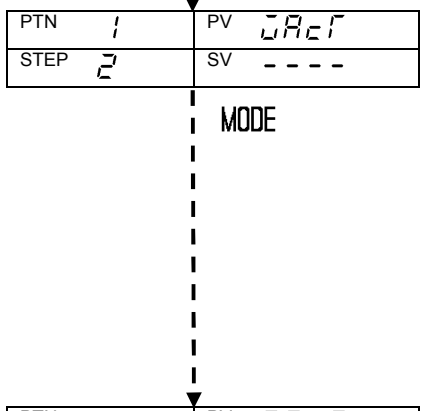
[Wait parameter setting mode]



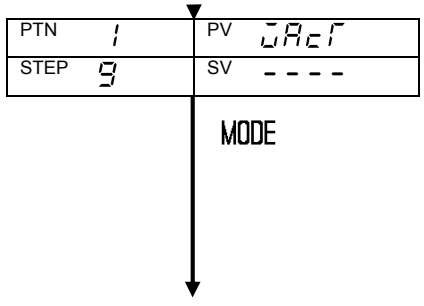
Wait value
Sets Pattern 1 Wait value.
The step of which temperature is rising:
Step SV – Wait value
The step of which temperature is falling:
Step SV + Wait value
Wait action is disabled when set to 0 or 0.0.
• Setting range: ±(0 to 100)℃ (℉)
For the input with a decimal point:
±(0.0 to 100.0)℃ (℉)
For DC input: ±(0 to 1000)(The placement of the decimal point follows the selection.)
• Default value: 0℃ (℉)



Step 1 Wait function
Selects Step 1 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: Wait function Not used



Step 2 Wait function
Selects Step 2 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: Wait function Not used



Step 9 Wait function
Selects Step 9 Wait function Used or Not used.
Not available if Wait value is set to 0 or 0.0℃(℉) during Wait value setting.
• Selecting item:
----: Wait function Not used
USE: Wait function Used
• Default value:
----: WAIT function Not used

[Program standby mode or Program control run mode]

PTN 1	PV Actual temp.
STEP	SV

(8) Auxiliary function setting mode 1

Settings/Selections in Auxiliary function setting mode 1 are common to all program pattern numbers.

[Program standby mode or Program control run mode]

PTN 1	PV Actual temp.
STEP	SV

▽ + MODE (3 sec)

Press the MODE Key for 3 seconds while holding down the ▽ key.
Auxiliary function setting mode 1 appears, and Set value lock selection item is indicated.

[Auxiliary function setting mode 1]

PTN	PV Lock
STEP	SV ----

MODE

Set value lock

Locks the set value to prevent setting errors. Before selecting the lock function, set each setting item in advance.

Unlock: All set values can be changed.
Lock : None of the set values can be changed.

- Selecting item: ---- (Unlock)
  Lock (Lock)
- Default value: ---- (Unlock)

PTN	PV SH
STEP	SV 1370

MODE

SV high limit

Sets the step SV high limit.

- Setting range:
  SV low limit to input range high limit value
  DC input: SV low limit to scaling high limit value
- Default value: 1370℃

PTN	PV SL
STEP	SV -200

MODE

SV low limit

Sets the step SV low limit.

- Setting range:
  Input range low limit value to SV high limit
  DC input: scaling low limit value to SV high limit
- Default value: -200℃

PTN	PV Sb
STEP	SV 0.0

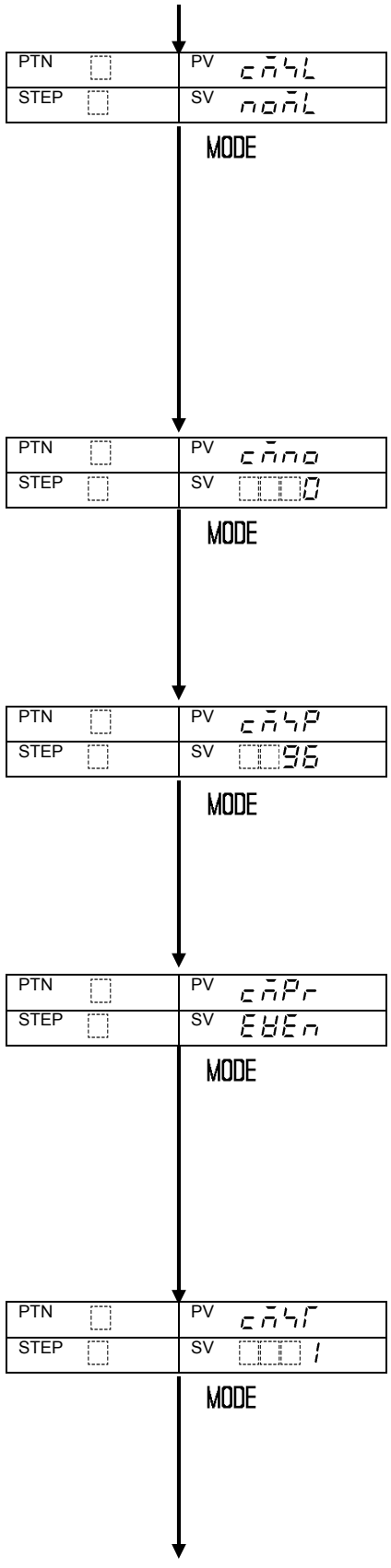
MODE

Sensor correction

Sets the value to correct PV.

PV after sensor correction= Current PV+ Sensor correction value

- Setting range: -100.0℃ to 100.0℃ (℉)
  DC input: -1000 to 1000 (The placement of the decimal point place follows the selection.)
- Default value: 0.0℃



Communication protocol

Selects the communication protocol.
Available only when C5/SVTC (option) is added.

- Selecting item:
  - NONL Shinko protocol
  - SHR Set value digital transmission (Shinko protocol)
  - SHRr Set value digital reception (Shinko protocol)
  - ModA Modbus protocol ASCII mode
  - Modr Modbus protocol RTU mode
- Default value: NONL Shinko protocol

Instrument number

Selects the instrument number.
Set the instrument number of the PCD-33A individually when communicating by connecting plural PCD-33A units.
Available only when C5/SVTC (option) is added.

- Setting range: 0 to 95
- Default value: 0

Communication speed

Selects the communication speed.
Available only when C5/SVTC (option) is added.

- Selecting item: 24 2400bps
  48 4800bps
  96 9600bps
  192 19200bps
- Default value: 96 9600bps

Parity

Selects the parity type from a choice of: No parity, Even and Odd parity in accordance with the host computer.
Available when C5/SVTC (option) is added, and when Modbus ASCII or RTU mode is selected.

- Selecting item: NONE No parity
  EVEN Even parity
  odd Odd parity
- Default value: EVEN Even parity

Stop bit

Selects the stop bit in accordance with the host computer from 1 or 2.
Available when C5/SVTC (option) is added, and when Modbus ASCII or RTU mode is selected.

- Selecting item: 1 (stop bit 1)
  2 (stop bit 2)
- Default value: 1 (stop bit 1)

[Program standby mode or Program control run mode]

PTN 1	PV Actual temp.
STEP	SV

(9) Auxiliary function setting mode 2

The settings in Auxiliary function setting mode 2 have already been completed in Section “5. Setup” (p.14).

(10) Data clearing function

This function returns all set values to the default values (See pages 58, 59).
This function can only be used during Program standby mode.
This function can not be used during Program control run mode.

⚠ Caution

Be sure to write down all set values for all patterns before clearing data, using the photocopiable pages at the end of this manual.
Once data has been cleared, the set values have to be inputted again since the lost data can not be restored.

[Program standby mode]

PTN 1	PV Actual temp.
STEP	SV

Press the STOP Key for 3 seconds while holding down the △ and ▽ keys.

△ + ▽ + STOP(3 sec)

[Data clearing]

PTN	PV clr
STEP	SV

All set values are cleared and they return to their default values.
During data clearing, the PV display indicates clr, and other displays are turned off.

[Program standby mode]

PTN 1	PV Actual temp.
STEP	SV

After data is cleared, the controller automatically reverts to the Program standby mode.

7. Running

[Before running]

Before running the controller, check the mounting and wiring carefully, referring to "3. Mounting to the control panel" (p.8) and "4. Wiring" (p.10).

Check that settings are applicable for the users' conditions, referring to "5. Setup" (p.14).

7.1 How to set the program

Set the following items, referring to "6. Operation" (p.21)

(1) Program pattern number (p.24)

(2) Pattern (Step SV/Time) setting mode (p.25)

Set the following items as needed.

(3) Alarm/Time signal setting mode (p.27)

(4) PID parameter setting mode (p.28)

(5) Wait parameter setting mode (p.29)

(6) Auxiliary function setting mode 1 (p.31)

(7) Auxiliary function setting mode 2 (Refer to "5. Setup") (p.14)

7.2 Performing program control

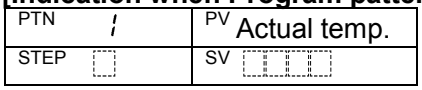
Follow the procedures below in carrying out the program control.

(1) Select a program pattern number.

Select the desired program pattern number to perform program control by pressing the PTN Key in the Program standby mode.

Each time the PTN Key is pressed, the program pattern number is switched.

[Indication when Program pattern 1 is selected]



PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display: Unlit
SV display : Unlit
All indicators : Unlit

(2) Perform the program control.

Press the RUN Key.

The program control of the selected program pattern number will be started.

The program control can also be started by connecting (Contact from Open to Closed) external operation input terminals 14 and 17.

The program control cannot be performed if pattern end output is turned on. Press the STOP Key to turn the pattern end output off, then press the RUN Key.

[Control action when the program control starts]

Program control type selected during the selection phase will initiate.

PV start: When the program control starts, step SV and step time are advanced to the PV, then the program control is performed.
However, if a value set during “Step SV for control start” and the step SV are equal, or if the value set during “Step SV for control start” is higher than PV, PV start is cancelled, and SV start is adopted.
When Wait function is set, the Wait function has priority.

SV start: When the program control starts, the program control starts from the value which has been set during “Step SV for control start”.

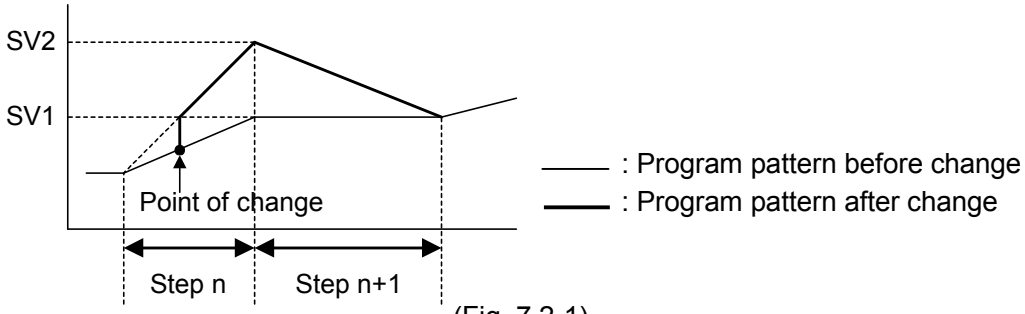
[Indication during program control run]

PTN /	PV Actual temp.
STEP /	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running
SV display : Current step SV
RUN indicator : Lit during program control run
Other indicators: Lit or unlit according to the controller status

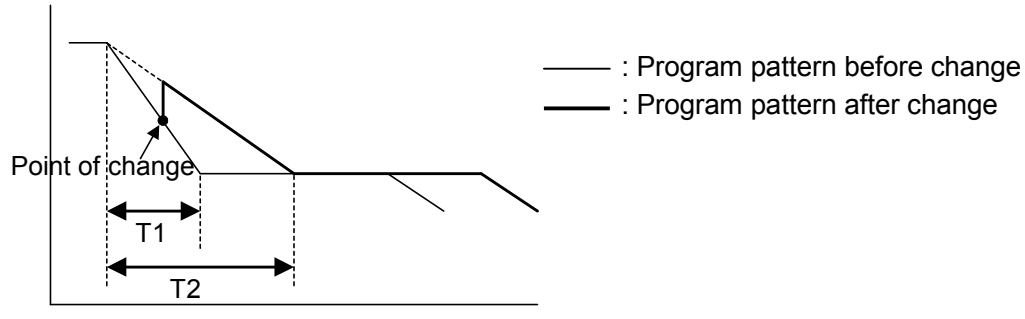
[Step SV or Step time change during running]

(1) When the step SV is changed from SV1 to SV2



(Fig. 7.2-1)

(2) When the step time is changed from T1 to T2



(Fig. 7.2-2)

[Action after power is restored]

(1) If power failure occurs during the program control run, the control resumes from the point at which power failure occurred.
(2) If power failure occurs during Program standby mode, the control resumes from the Program standby mode.

[Indication during Wait action]

PTN	PV Actual temp.
STEP	SV Step SV

Flashes during WAIT action.

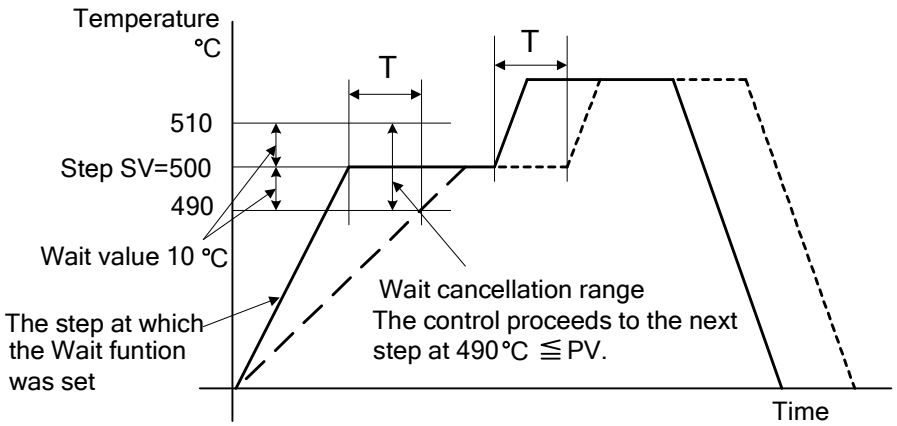
PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Flashes during Wait action.
SV display : Current step SV
RUN indicator : Lit during program control
Other indicators: Lit or unlit according to the controller status

[Wait function]

During the program control run, the program does not proceed to the next step until the deviation between PV and Step SV enters the Step SV ± Wait value when the step ends.
While the Wait function is working, the numeric value on the Step display flashes.

The Wait function is cancelled on the condition that:
(Step SV – Wait value)≦PV≦(Step SV + Wait value)

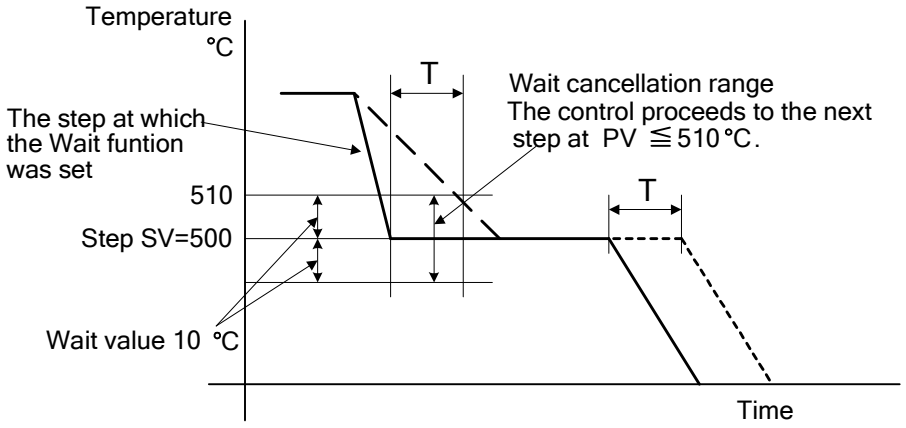
When the program pattern is rising [The Wait function is cancelled at (Step SV – Wait value)≦PV]



——— : Program pattern
— — - : PV
------- : Program pattern which is delayed by T due to the Wait function
T : Wait time

(Fig. 7.2-3)

When the program pattern is falling [The Wait function is cancelled at PV≦(Step SV + Wait value)]

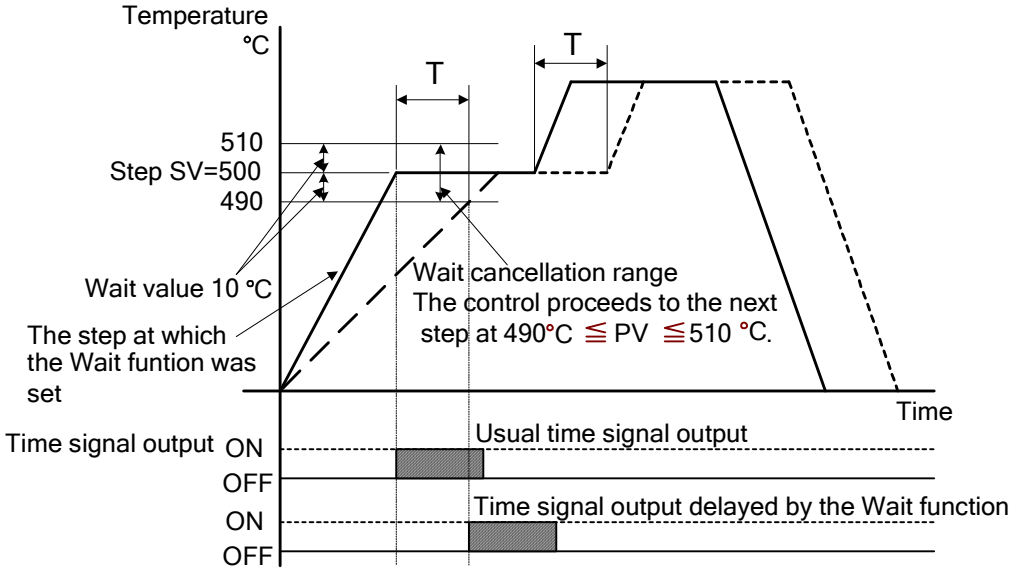


——— : Program pattern
— — - : PV
------- : Program pattern which is delayed by T due to the Wait function
T : Wait time

(Fig. 7.2-4)

[Time signal action during WAIT action]

During Wait action, time signal time measurement as well as step time pauses. After Wait function is cancelled, time signal time measurement resumes.



——— : Program pattern
— — - : PV
------- : Program pattern which is delayed by T due to the Wait function
T : Wait time

(Fig. 7.2-5)

[Indication during Time signal action]

If Time signal output is selected during the [Event output function selection], Event output is turned on during time signal output ON time.

Time signal output ON time follows time signal output OFF time after the program control starts.

If Time signal output ON time has elapsed, Event output is turned off.

The following shows the indication during time signal action.

PTN 1	PV Actual temp.
STEP 1	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running.
SV display : Current step SV
RUN indicator : Lit during program control run
EVT indicator : Lit during Time signal output ON
Other indicators: Lit or unlit according to the controller status

[Indication during Pattern end output]

If Pattern end output is selected during the Event output function selection, Event output is turned on for the time which has been set during the Pattern end output time setting.

If Pattern end output time has elapsed, Event output is turned off.

If Pattern end output time is set to 0, the output remains ON.

By pressing the STOP Key for 1 second or longer, the pattern end output is turned off, and the controller reverts to the Program standby mode.

The following shows the indication during pattern end output.

PTN 1	PV Actual temp.
STEP ⬚	SV P.End

Flashes while Pattern end output is ON.

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Unlit
SV display : P.End flashes while pattern end output is on.
RUN indicator : Unlit
EVT indicator : Lit while pattern end output is ON
Other indicators: Unlit

[Indication during Run output]

If Run output is selected during the Event output function selection, Event output is turned on during program control run.

When the program control ends or when making program control stop by pressing the STOP Key for 1 second or longer, Event output is turned off.

The following shows the indication during Run output.

PTN 1	PV Actual temp.
STEP 1	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step number of the program control which is running
SV display : Current step SV
RUN indicator : Lit
EVT indicator : Lit while Run output is ON
Other indicators: Lit or unlit according to the controller status

7.3 Stopping program control

Pressing the STOP Key for 1 second or longer stops the program control.
The program control also stops by disconnecting (Contact from Closed to Open) external operation input terminals 14 and 17.

[Indication after program control stops]

PTN 1	PV Actual temp.
STEP	SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Unlit
SV display : Unlit
All indicators : Unlit

7.4 Advance function (Advances to the next step during program control run)

To cancel the current step and advance to the next step during the program control, press the RUN Key for 1 second or longer.
This function is also usable during Wait action or during Fixed value control action.

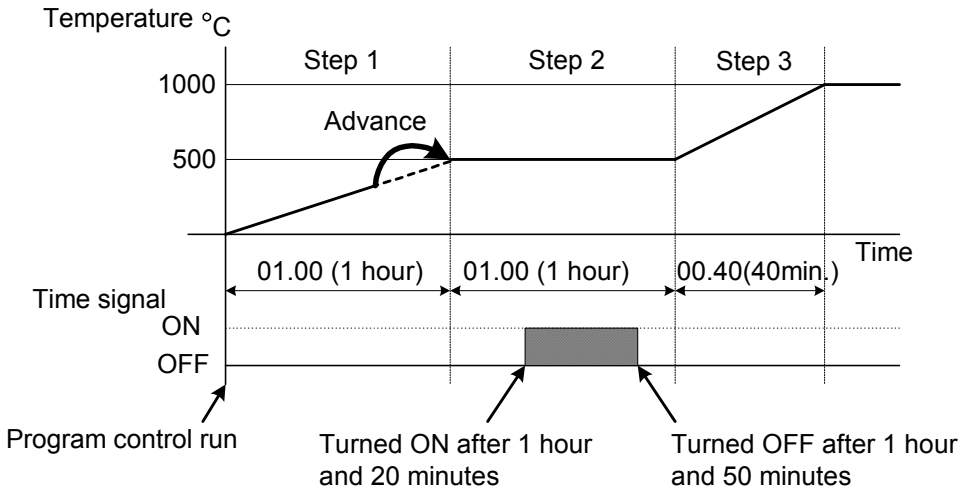
[Indication when Advance function is used at Step 1]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step 2 after the Advance function is used.
SV display : Current step SV
RUN indicator : Lit during program control run
Other indicators: Lit or unlit according to the controller status

[Time signal action after Advance function is used]

If Advance function is used, only the step time advances. Time signal output timing does not change.
The following example shows that when Advance function is used during Step 1, time signal output is turned on 20 minutes after Step 1 is advanced to Step 2.



Setting Time signal OFF time: 1 hour and 20 minutes,
Time signal ON time: 30 minutes

(Fig. 7.4-1)

7.5 Switching to Fixed value control (Hold function)

Fixed value control (identical to control of the indicating controllers) at the step SV can be carried out when the step time is held.

[How to switch to Fixed value control at Step 2]

[During Program control run]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

MODE (4 times)

Press the MODE Key 4 times.
Step 2 time setting item is indicated.

[Step 2 time setting]

PTN 1	PV TIME
STEP 2	SV Step time

▽ (Keep pressing)

Keep pressing the ▽ key.
Step time switches from [0.00] to [----],
which is the Hold function characters.

PTN 1	PV TIME
STEP 2	SV ----

RST

Performs fixed value control.

Press the RST Key.
Fixed value control can be performed at the step SV as the desired value.

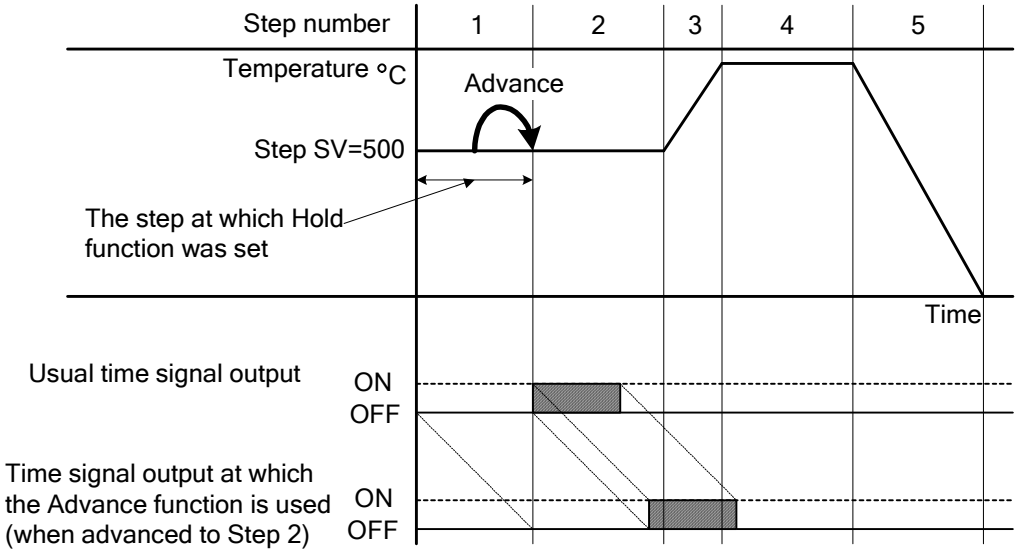
[Indication when switched to fixed value control at Step 2]

PTN 1	PV Actual temp.
STEP 2	SV Step SV

PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Step 2 after switching to the Fixed value control
SV display : Step 2 SV
RUN indicator : Flashes during fixed value control.
Other indicators : Lit or unlit according to the controller status.

[Time signal action during fixed value control]

During the fixed value control, step time of the step at which the Hold function was set is regarded as (00:00). Time signal time measurement is carried out ignoring this step.



(Fig. 7.5-1)

[Action after the power is restored]

If power failure occurs during fixed value control, fixed value control resumes after the power is restored.

7.6 Correcting PV (Sensor correction function)

[Sensor correction function]

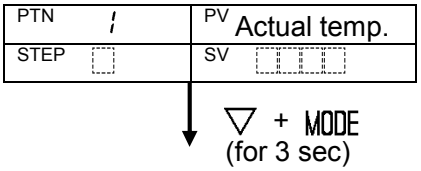
This corrects the input value from the sensor. When a sensor cannot be set at the exact location where control is desired, the sensor measured temperature may deviate from the temperature in the controlled location.

When controlling with plural controllers, sometimes the measured temperatures (input values) do not concur due to differences in sensor accuracy or dispersion of load capacities. In such a case, the control can be set at the desired temperature by adjusting the input value of the sensors. However, it is effective within the input rated range regardless of the sensor correction value.

PV after sensor correction = Current PV + (Sensor correction value)

[How to set sensor correction value]

[Program standby mode or Program control run mode]



Press the MODE Key for 3 seconds while holding down the ▽ key.

The unit enters Auxiliary function setting mode 1, and Set value lock selection is indicated.

[Auxiliary function setting mode 1]

PTN	PV Lock
STEP	SV Selection

MODE (Press 3 times)

Press the MODE Key 3 times.
Sensor correction setting item is indicated.

PTN	PV Ho□□
STEP	SV □□0.0

△ , ▽

Set the sensor correction value with the △ or ▽ key.
Setting range: -100.0 to 100.0℃ (℉)
DC input: -1000 to 1000 (The placement of the decimal point follows the selection.)

PTN	PV Ho□□
STEP	SV Set value

RST

Press the RST Key.
The controller reverts to the Program standby mode or Program control run mode.

[Program standby mode or Program control run mode]

PTN 1	PV Actual temp.
STEP	SV □□□□

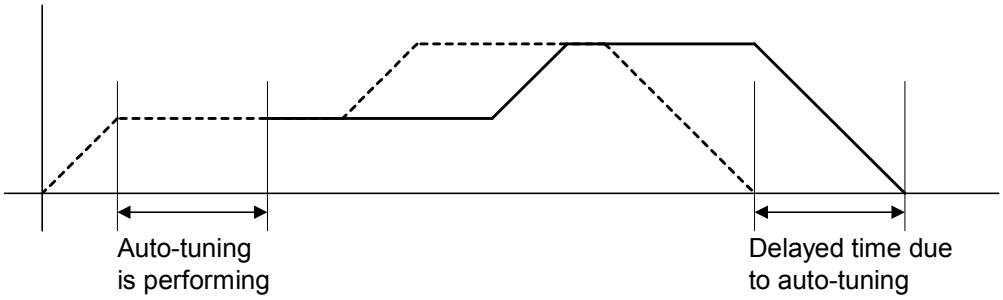
The value on the PV display is the one corrected by the sensor.
(e.g.) If actual temperature is 200℃, and sensor correction value is -2.0℃, PV becomes 198℃.

7.7 Auto-tuning (AT)

In order to set each value of P, I, D and ARW automatically, the auto-tuning process should be made to fluctuate.
For DC input, the AT process will fluctuate around the SV (desired value) for conditions of (A), (B) and (C) on page 43.

⚠ Notice

- Perform the auto-tuning during the trial run.
- During the auto-tuning, none of the setting items can be set.
- If auto-tuning is performed, auto-tuning starts at the same time as performance, and step time and time signal time do not progress until the auto-tuning ends. After the auto-tuning ends, the remaining step time is performed.
- If power failure occurs during the auto-tuning, the tuning stops.
- **Sometimes the auto-tuning process will not fluctuate if auto-tuning is performed at or near room temperature. Therefore auto-tuning might not finish normally.**



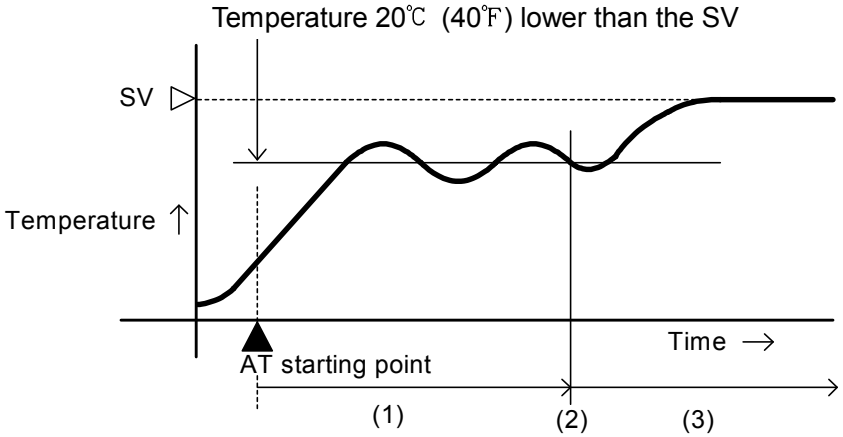
---------: Pattern before the auto-tuning is performed
————: Pattern after the auto-tuning is performed

(Fig. 7.7-1)

[Auto-tuning performing conditions]

(A) When processing temperature is lower than [SV –20℃ (40℉)]

The AT process will fluctuate at the temperature 20℃ (40℉) lower than the SV.

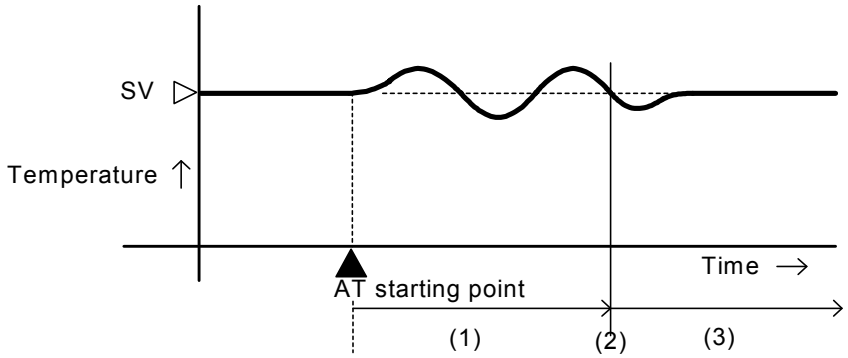


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.

(Fig. 7.7-2)

(B) When the control is stable or when processing temperature is within [SV±20℃ (40℉)]

The AT process will fluctuate around the SV.

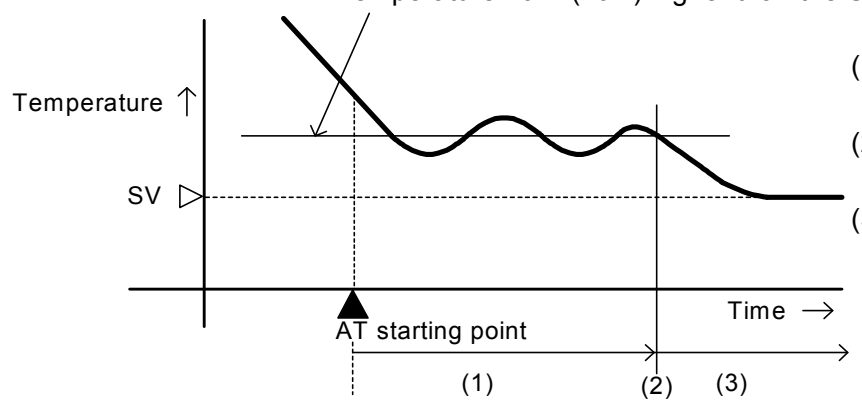


(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.

(Fig. 7.7-3)

(C) When the processing temperature is higher than [SV+20℃ (40℉)]

The AT process will fluctuate at the temperature 20℃ (40℉) higher than the SV.



(1) Calculating PID constant
(2) PID constant calculated
(3) Controlled by the PID constant set by auto-tuning.

(Fig. 7.7-4)

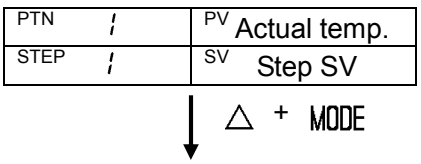
[If P, I, D, ARW values cannot be changed]

- If auto-tuning does not finish in 4 hours after it has started, it will be cancelled automatically, and P, I, D, ARW values return to the value set before the auto-tuning was performed. In this case, set P, I, D, ARW values manually.
- If auto-tuning is cancelled during the process, P, I, D, ARW values return to the value set before the auto-tuning was performed.

[How to perform auto-tuning]

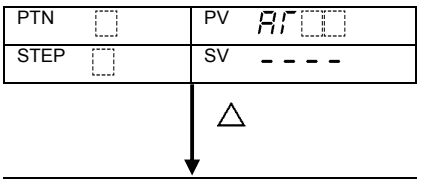
Auto-tuning can be performed only during Program control run mode.
Auto-tuning cannot be performed during the Program standby mode or during any other control actions except PID control.

[Program control run mode]

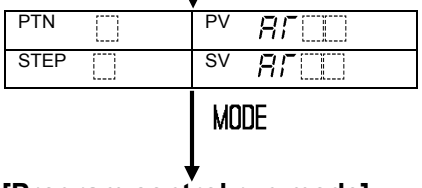


Press the MODE Key while pressing the △ key.
The unit enters the PID parameter setting mode, and AT Perform/Cancel item is indicated.

[PID parameter setting mode]

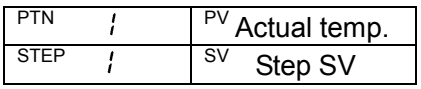


AT Perform/Cancel selection
Press the △ key.

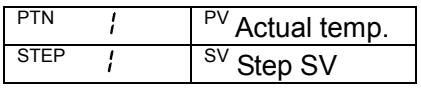


Press the MODE Key.
The controller reverts to the Program control run mode, and auto-tuning is performed.

[Program control run mode]



[Indication during AT Perform]

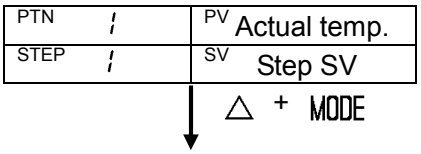


PTN display : Selected program pattern number
PV display : Current actual temperature
STEP display : Current step number
SV display : Current step SV
RUN indicator : Lit during program control run
AT indicator : Flashes during AT Perform.
Other indicators : Lit or unlit according to the controller status.

[How to cancel auto-tuning]

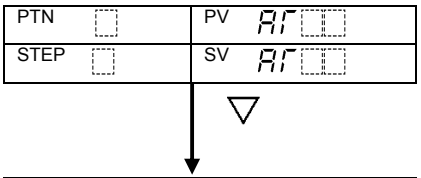
Available only during AT Perform

[AT is performing]

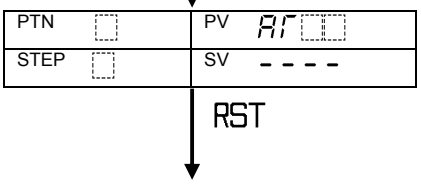


Press the MODE Key while holding down the △ key.
The unit enters the PID parameter setting mode, and AT Perform/Cancel item is indicated.

[PID parameter setting mode]

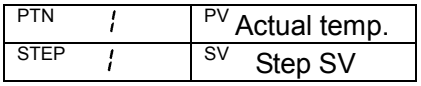


AT Perform/Cancel selection
Press the ▽ key.



Press the RST Key.
Auto-tuning is cancelled, and the controller reverts to the Program control run mode.

[Program control run mode]



8. Control and Alarm action

8.1 P, I, D, ARW action

(1) Proportional band (P)

Proportional action is the action which the control output (OUT) varies in proportion to the deviation between the SV (desired value) and the PV (processing temperature).
If the proportional band is narrowed, even if the output changes by a slight variation of the processing temperature, better control results can be obtained as the offset decreases.
However, if the proportional band is narrowed too much, even slight disturbances may cause variation in the processing temperature, control action changes to ON/OFF control and the so-called hunting phenomenon occurs.
Therefore, when the processing temperature comes to the balanced position near the SV and a constant temperature is maintained, the most suitable value is selected by gradually narrowing the proportional band while observing the control results.

(2) Integral time (I)

Integral action is used to eliminate offset. When the integral time is shortened, the returning speed to the SV (desired value) is accelerated. However, the cycle of oscillation is also accelerated and the control becomes unstable.

(3) Derivative time (D)

Derivative action is used to restore the change in the processing temperature (PV) according to the rate-of-change. It reduces the amplitude of overshoot and undershoot width.

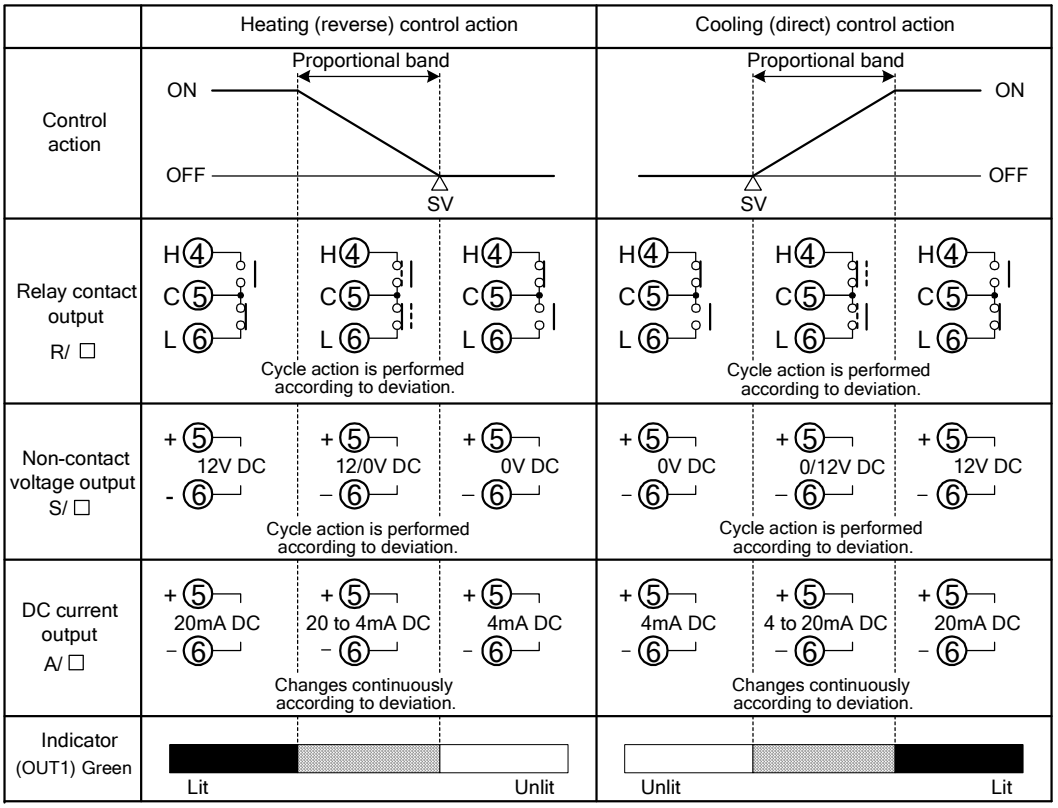
If the derivative time is shortened, the restoring value becomes smaller, and if the derivative time is extended longer, an excessive returning phenomenon may occur and the control system may oscillate.

(4) ARW (Anti-reset windup)

ARW (Anti-reset windup) prevents overshoot caused by the integral action. The smaller the ARW value, the less the overshoot caused by the integral action in the transition status, however stabilization will take some time.

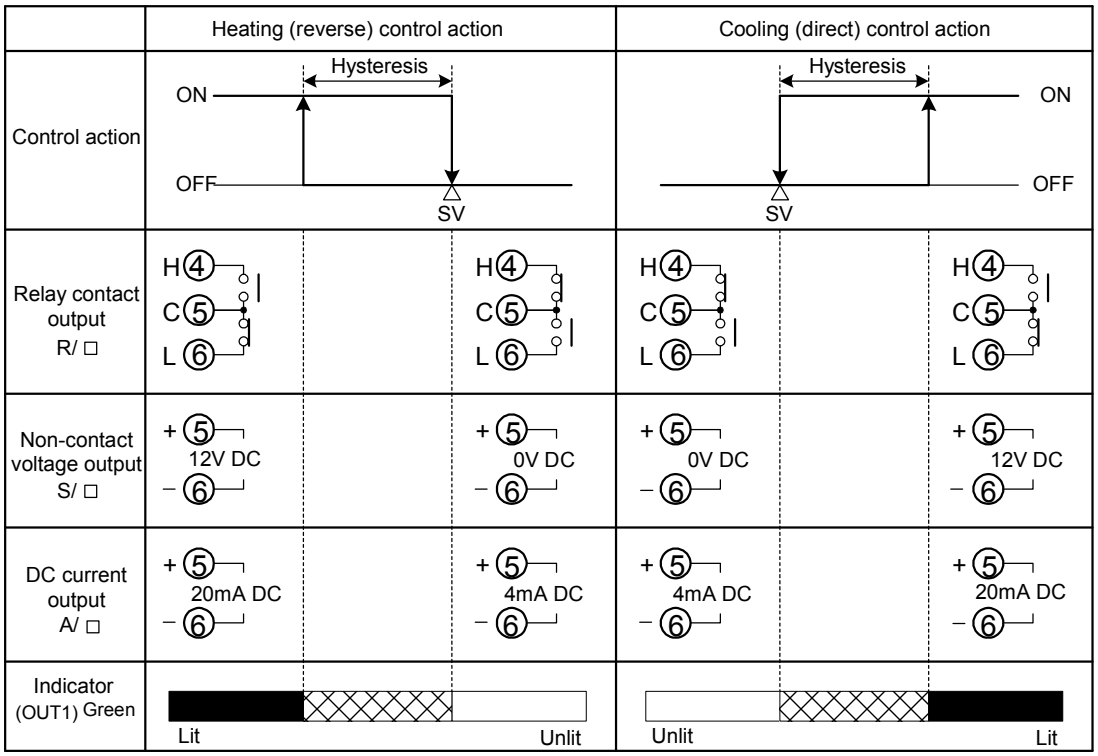
When setting ARW manually, set it to the closest MV (manipulated variable) when the control is stabilized.

8.2 Standard action

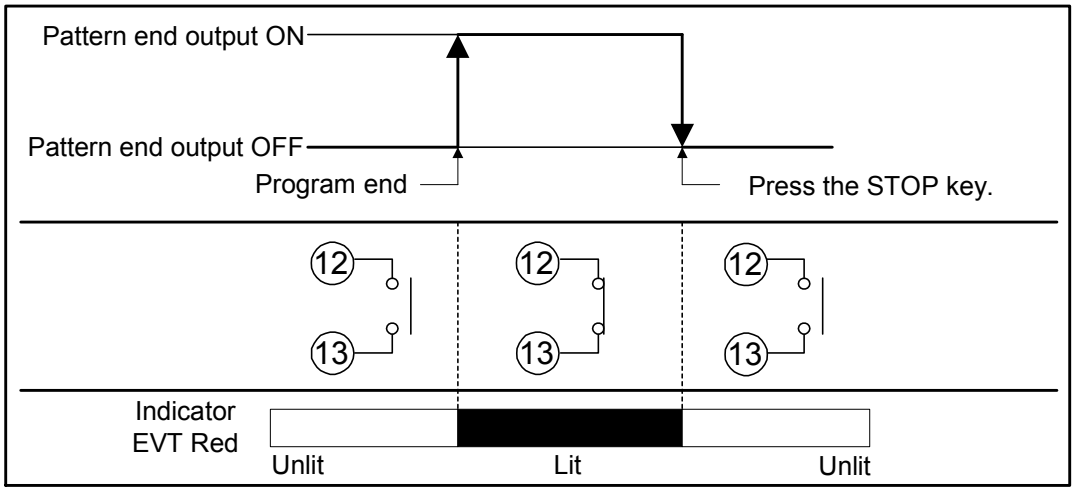


: Turns ON (lit) or OFF (unlit).

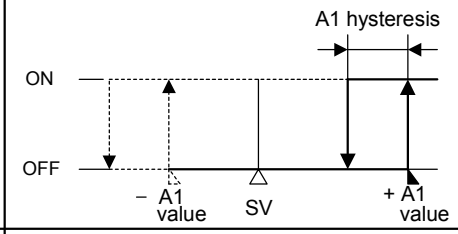
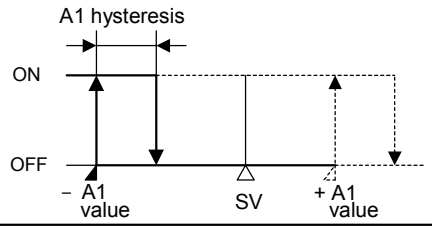
8.3 ON/OFF control action



8.4 Pattern end output action



8.5 Alarm 1 (A1), Alarm 2 (A2) action

<table>
<tr><td></td><td>High limit alarm</td><td>Low limit alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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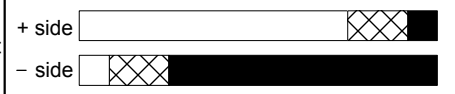
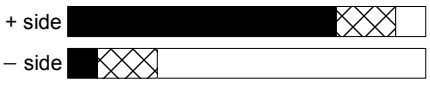
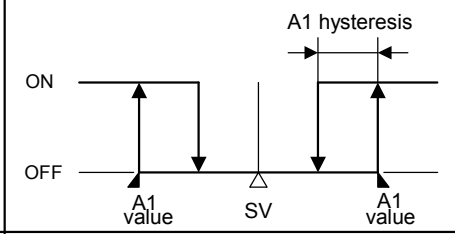
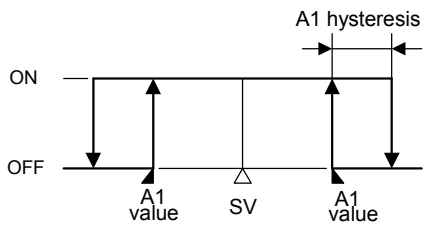
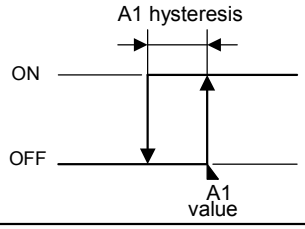
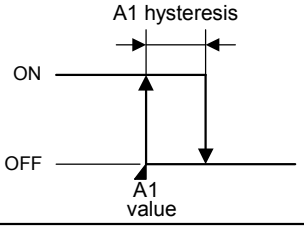
<tr><td>Alarm output</td><td> 
</td><td> 
</td></tr>
<tr><td></td><td>High/Low limits alarm</td><td>High/Low limit range alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
</td></tr>
<tr><td>Alarm output</td><td> </td><td> </td></tr>
<tr><td></td><td>Process high alarm</td><td>Process low alarm</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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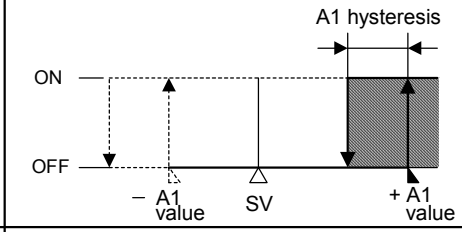
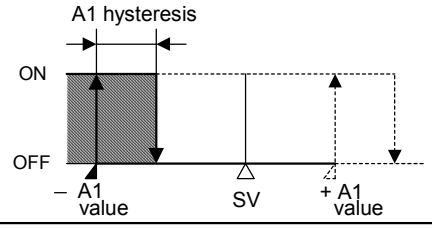
<tr><td>Alarm output</td><td> </td><td> </td></tr>
<tr><td></td><td>High limit alarm with standby</td><td>Low limit alarm with standby</td></tr>
<tr><td>Alarm action</td><td> 
</td><td> 
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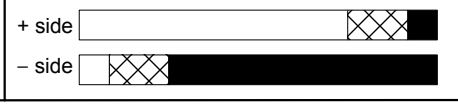
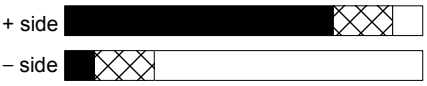
<tr><td>Alarm output</td><td> 
</td><td> 
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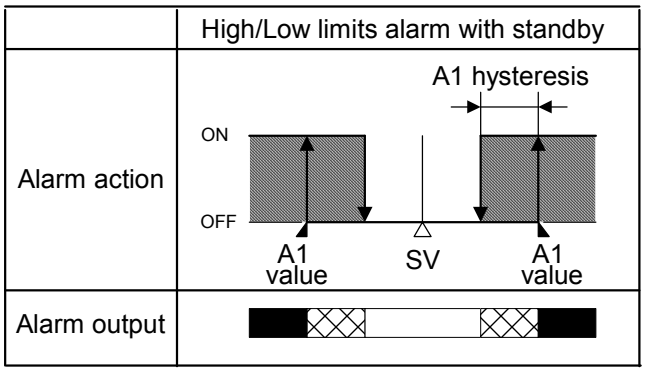


: A1 output terminals 7 and 8 are connected (ON).

: A1 output terminals 7 and 8 are connected (ON) or disconnected (OFF).

: A1 output terminals 7 and 8 are disconnected (OFF).

: Standby functions.

Alarm indicator and Alarm output

For A2 output, use terminals 12 and 13.

A1 and A2 indicators light when their terminals are connected, and go off when their terminals are disconnected.

When Alarm 1 (A1) De-energized or Alarm 2 (A2) De-energized is selected during Alarm 1 (A1) or Alarm 2 (A2) Energized/De-energized selection, the alarm output ON/OFF status acts in reverse. In this case, A1 and A2 indicators light when their terminals are disconnected, and go off when their terminals are connected.

Alarm action in overscale and underscale

During overscale, High limit alarm, High/Low limits alarm and Process high alarm are activated.

During underscale, Low limit alarm, High/Low limits alarm and Process low alarm are activated.

For the alarm with standby function, the standby function is released.

9. Other functions

Power failure countermeasure

The setting data is backed up in the non-volatile IC memory.

If power failure occurs during the program control run, and if the power is restored, the program control resumes from the point at which power failure occurred.

If power failure occurs during the fixed value control, and if the power is restored, the fixed value control resumes.

Self-diagnosis

The CPU is monitored by a watchdog timer, and if an abnormal status is found on the CPU, the controller is switched to warm-up status.

Automatic cold junction temperature compensation (Only thermocouple input type)

This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always maintains it at the same status as if the reference junction location temperature was at 0℃ (32℉).

Burnout

When the **thermocouple or RTD input** is burnt out, PV display flashes "‾ ‾ ‾ ‾" (For DC current output, OUT low limit value) with control output (OUT) being turned off.

When **DC input** is disconnected:

For 4-20mA DC and 1-5V DC input, the PV display flashes "_ _ _ _".

For 0-1V DC input, the PV display flashes "‾ ‾ ‾ ‾".

For 0-20mA DC, 0-5V DC and 0-10V DC input, the PV display indicates the value corresponding with 0mA or 0V input.

Input error

Indication	Contents	Control output
[‾ ‾ ‾ ‾] flashes.	Overscale Measured value has exceeded indication range high limit value.	Relay contact: OFF Non-contact voltage: 0V DC current output: 4mA or OUT low limit value
[_ _ _ _] flashes.	Underscale Measured value has dropped below indication range low limit value.	Relay contact: OFF Non-contact voltage: 0V DC current output: 4mA or OUT low limit value

Thermocouple input

Input	Input range	Indication range	Control range
K, T	-199.9 to 400.0℃	-199.9 to 450.0℃	-205.0 to 450.0℃
	-199.9 to 750.0℉	-199.9 to 850.0℉	-209.0 to 850.0℉

Indication range and Control range of thermocouple inputs other than the above:
Input range low limit value –50℃ (100℉) to Input range high limit value +50℃ (100℉)

RTD input

Input	Input range	Indication range	Control range
Pt100	-199.9 to 850.0℃	-199.9 to 900.0℃	-210.0 to 900.0℃
	-200 to 850℃	-210 to 900℃	-210 to 900℃
	-199.9 to 999.9℉	-199.9 to 999.9℉	-211.0 to 1099.9℉
	-300 to 1500℉	-318 to 1600℉	-318 to 1600℉
JPt100	-199.9 to 500.0℃	-199.9 to 550.0℃	-206.0 to 550.0℃
	-200 to 500℃	-206 to 550℃	-206 to 550℃
	-199.9 to 900.0℉	-199.9 to 999.9℉	-211.0 to 999.9℉
	-300 to 900℉	-312 to 1000℉	-312 to 1000℉

DC input

Indication range: [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]
(If the input value goes outside the range –1999 to 9999, the PV display flashes "‾ ‾ ‾ ‾" or "_ _ _ _".)

Control range: [Scaling low limit value – Scaling span x 1%] to [Scaling high limit value +Scaling span x 10%]

10. Specifications

10.1 Standard specifications

Model : Programmable controller
Name : PCD-33A
Mounting : Flush
Setting : Input system using membrane sheet key
Display PV display : Red LED display 4 digits, character size, 18(H) x 8(W)mm
SV display : Green LED display 4 digits, character size, 12.6(H) x6(W)mm
PTN display : Green LED display 1 digit, character size, 12.6(H) x 6(W) mm
STEP display : Green LED display 1 digit, character size, 12.6(H) x 6(W) mm

Input

Thermocouple : K, J, R, S, B, E, T, N, PL-Ⅱ, C
External resistance, 100Ω or less (for B input, 40Ω or less)

RTD : Pt100, JPt100, 3-wire system
Allowable input lead wire resistance, 10Ω or less per wire

DC current : 0 to 20mA DC, 4 to 20mA DC
Input impedance 50Ω
Allowable input current 50mA DC or less
[50Ω shunt resistor (sold separately) must be installed between input terminals.]

DC voltage : 0 to 1V DC
Input impedance (1MΩ or more)
Allowable input voltage (5V DC or less)
Allowable signal source resistance (2kΩ or less)
: 0 to 5V DC, 1 to 5V DC, 0 to 10V DC
Input impedance (100kΩ or more)
Allowable input voltage (15V DC or less)
Allowable signal source resistance (100Ω or less)

Input sampling period : 250ms

Accuracy (Indication and setting)

Thermocouple : Within ±0.2% of each input span ±1digit, or within ±2℃ (4℉), whichever is greater
R, S input, the range 0 to 200℃ (0 to 400℉): Within ±6℃ (12℉)
B input, the range 0 to 300℃ (0 to 600℉): Accuracy is not guaranteed.
K, J, E, T, N input, less than 0℃ (32℉): Within±0.4% of each input span ±1digit

RTD : Within ±0.1% of each input span ±1digit, or within ±1℃ (2℉), whichever is greater

DC current, voltage : Within ±0.2% of each input span ±1digit

Time indication accuracy: Within ±0.5% of the setting time

Program performance

Number of patterns : 9
Number of steps : 9 steps/1 pattern
Program time range: 0 to 99 hours 59 min/1 step, or 0 to 99 min 59 sec/1 step
For each step, ---- (Program control Hold) can be set. Fixed value control at the step SV can be performed since Hold function works.
Time setting accuracy: Within ±0.5% of the setting time

Setting resolution
Step SV : Refer to Section “1.2 Rated input” (p. 6).
Step time : 1 minute or 1 second
Status after power is restored: The control resumes from the point at which power failure occurred.
(Progressing time error after power is restored: Max. 1 minute)

Controlling action

- PID control (with auto-tuning function)
- PI control (When derivative time is set to 0)
- PD control (When integral time is set to 0)
- P control (When both integral and derivative time are set to 0)
- ON/OFF control (When proportional band is set to 0 or 0.0)

Proportional band (P) : TC, RTD input without a decimal point,
0 to 1000℃ (2000℉) (Default: 10℃)
TC, RTD input with a decimal point:
0.0 to 999.9℃ (999.9℉)
DC input: 0.0 to 100.0%
Integral time (I) : 0 to 1000 sec (Off when set to 0) (Default: 200 sec)
Derivative time (D) : 0 to 300 sec (Off when set to 0)) (Default: 50 sec)
Proportional cycle : 1 to 120 sec (Default: 30 sec for –R/M, 3 sec for –S/M,
Not available for –A/M)
Anti-reset windup (ARW) : 0 to 100% (Default: 50%)
ON/OFF hysteresis : 0.1 to 100.0℃ (℉) (Default: 1.0℃)
Output high limit, low limit: 0 to 100% (DC current output: -5 to 105%)
(Default: Output high limit; 100%, Output low limit; 0%)

Control output (OUT)

Relay contact : 1a1b
Control capacity: 3A 250V AC (resistive load)
1A 250V AC (inductive load cosϕ=0.4)
Electric life: 100,000 cycles
Non-contact voltage : For SSR drive
12^{+2}_{0}V DC maximum 40mA DC (short circuit protected)
Current : 4 to 20mA DC
Load resistance: Maximum 550Ω

Alarm 1 (A1) and Alarm 2 (A2) output

The alarm action point is set by ±deviation from the SV or step SV (except Process alarm). When the input goes outside the range, the output is turned ON or OFF (for High/Low limit range alarm).

Alarm Energized (When Alarm output is turned ON, Alarm indicator lights, and when Alarm output is turned OFF, the alarm indicator goes off) or De-energized (When Alarm output is turned ON, Alarm indicator goes off, and when Alarm output is turned OFF, the alarm indicator lights) can be selected by keypad operation.

Setting accuracy : The same as the indication accuracy
Action : ON/OFF action
Hysteresis : 0.1 to 100.0℃ (℉) (Default value: 1.0℃)
DC current, voltage input: 1 to 1000 (The placement of the decimal point follows the selection.)
Output : Relay contact 1a
Control capacity: 3A 250V AC (resistive load)
1A 250V AC (inductive load cosϕ=0.4)
Electric life: 100,000 cycles

Alarm output action: One alarm can be selected by the front keypad from 9 types of alarm and no alarm action: High limit alarm, Low limit alarm, High/Low limits alarm, High/Low limit range alarm, Process high alarm and Process low alarm, High limit alarm with the standby function, Low limit alarm with the standby function, High/Low limits alarm with the standby function and No alarm action.
Default: No alarm action for Alarm 1(A1) and Alarm 2(A2)

Event output

One of the outputs can be selected by the front keypad from a choice of:
Time signal output, Pattern end output and Run (program control run) output.
Default value: Time signal output

Output: Relay contact 1a
Control capacity: 3A 250V AC (resistive load)
1A 250V AC (inductive load $\cos\phi$=0.4)
Electric life: 100,000 cycles

Time signal output:

Sets the amount of time for time signal output ON time and time signal output OFF time within one pattern time. Time signal output is turned on during time signal output ON time. Time signal output ON time follows time signal output OFF time.
Setting range: OFF time, 00.00 to 99.59 (Hour:Minute or Minute:Second)
ON time, 00.00 to 99.59 (Hour:Minute or Minute:Second)
The time unit can be selected from the Step time unit selection.
Default value: 00.00 (Hour:Minute)

Pattern end output:

After program control is complete, pattern end output is turned on during pattern end output setting time.
When set to 0, the output remains ON. The output is turned off by pressing the STOP Key for 1 second or longer.
Pattern end output time setting range: 0 to 9999 sec. (Default: 0 sec)

Run (program control run) output:

The program control run output is turned on during program control run.

Supply voltage : 100 to 240V AC 50/60Hz, 24V AC/DC 50/60Hz
For the supply voltage, 100 to 240V AC is standard.
For 24V AC/DC, "1" is entered after the model PCD-33A-x/M.

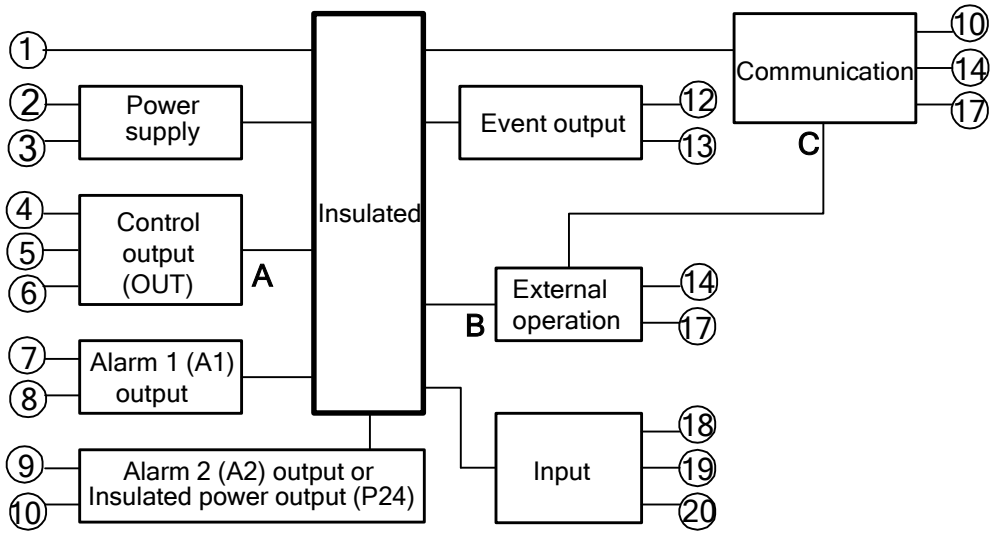
Allowable voltage fluctuation:
100 to 240V AC: 85 to 264V AC
24V AC/DC : 20 to 28V AC/DC

Ambient temperature : 0 to 50℃ (32 to 122℉)

Ambient humidity : 35 to 85%RH (non-condensing)

Power consumption: Approx. 8VA

Circuit insulation configuration



When the control output (OUT) is non-contact voltage or DC current,
A is not electrically insulated from B, and A is not electrically insulated from C.

Insulation resistance

10MΩ or more, at 500V DC for other combinations except those mentioned above.

Dielectric strength

Between input terminal and ground terminal,	1.5kV AC for 1 minute
Between input terminal and power terminal,	1.5kV AC for 1 minute
Between output terminal and ground terminal,	1.5kV AC for 1 minute
Between output terminal and power terminal,	1.5kV AC for 1 minute
Between power terminal and ground terminal,	1.5kV AC for 1 minute

Weight : Approx. 370g

External dimensions : 96 x 96 x 100mm (W x H x D)

Material : Case, Flame-resistant resin

Color : Case, Light gray

Attached functions : Set value lock, Sensor correction, Power failure countermeasure, Self-diagnosis, Automatic cold junction temperature compensation, Burnout (overscale), Input error, Warm-up indication

Accessories :

Mounting brackets	1 set
Instruction manual	1 copy
Terminal cover	2 pieces (When the TC option is added.)

10.2 Optional specifications

Serial communication (Option code: C5)

External operation function cannot be used if C5 option is added.

The following operations can be executed from an external computer.

(1) Reading and setting of Step SV, Step time, PID values and various set values
(2) Reading of the PV and the action status
(3) Function change

Communication interface : EIA RS-485
Communication method : Half-duplex communication
Synchronization method : Start-stop synchronization
Communication protocol : Shinko protocol, Set value digital transmission (Shinko protocol), Set value digital reception (Shinko protocol), Modbus ASCII, Modbus RTU
(Default: Shinko protocol)
Communication speed : 2400, 4800, 9600, 19200bps, (Default: 9600bps)
Selectable by keypad
Parity : Even, Odd, No parity (Selectable by keypad)
(Default: Even)
Stop bit : 1, 2 (Selectable by keypad) (Default: 1)
Data format : Data bit is automatically changed upon selecting a communication protocol.

Protocol	Shinko	Modbus ASCII	Modbus RTU
Start bit	1	1	1
Data bit	7	7	8
Parity	Even	Selection (Even)	Selection (No parity)
Stop bit	1	Selection (1)	Selection (1)

Value in the bracket ( ): Basic set value

Set value digital transmission (Option code: SVTC)

If SVTC option is added, external operation function cannot be used.

If Set value digital transmission is selected during Communication protocol selection, step SV of the PCD-33A can be transmitted digitally to a maximum of 31 units of Shinko controllers with communication function (C5 option).

If Set value digital reception is selected during Communication protocol selection, step SV can be received from Shinko PC-935/PCD-33A with Set value digital transmission (SVTC option).

Insulated power output (Option code: P24)

When P24 option is added, Alarm 2 (A2) cannot be used.

Output voltage: 24±3V DC (When load current is 30mA DC)

Ripple voltage: Within 200mV DC (When load current is 30mA DC)

Max. load current: 30mA DC

Color black (Option code: BK)

Front panel : Dark gray

Case : Black

Terminal cover (Option code: TC)

Electrical shock protection terminal cover

11. Troubleshooting

If any malfunctions occur, refer to the following items after checking the power and wiring.

⚠ Warning

Turn the power supply to the instrument off before checking the wiring. Working on or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.

<Indication>

Problem	Presumed cause and solution
[----] is flashing on the PV display.	• Thermocouple or RTD is burnt out. [Thermocouple] If the input terminals of the instrument are shorted, and if a value around room temperature is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. [RTD] If approx. 100Ω of resistance is connected to the input terminals between A-B of the instrument and between B-B is shorted, and if approximate 0℃ (32℉) is indicated, the instrument is likely to be operating normally, however, the sensor may be burnt out. • Check whether the input terminals of thermocouple, RTD are securely mounted to the instrument input terminals.
[----] is flashing on the PV display.	• Check if polarity of thermocouple or compensating lead wire is correct. • Check whether codes (A, B, B) of RTD agree with the instrument terminals.
The indication of PV display is irregular or unstable.	• Check whether sensor input or temperature unit (℃ or ℉) is correct. Set the sensor type which is the same as users' and the temperature unit during the Input type selection [InTy]. (p.16) • Sensor correcting value is unsuitable. Set it to a suitable value during the Sensor correction setting [Inb□] in Auxiliary function setting mode 1. (p.31, 41, 42) • AC leaks into thermocouple or RTD circuit. • There may be equipment that interferes with or makes noise near the controller. Keep equipment that interferes with or makes noise away from the controller.
[Err1] is indicated on the PV display.	• Internal memory is defective. Contact our agency or us.

<Keypad operation>

Problem	Presumed cause and solution
It is impossible to select a program pattern number.	• The program control is running. Change the mode. The program pattern number can only be selected during the Program standby mode.
Settings or selections are impossible.	• Set value lock [LocK] is designated during the Set value lock selection in Auxiliary function setting mode 1. Release the lock designation and set to [----]. (p.31) • Auto-tuning is performing. Cancel auto-tuning if necessary. (p.28)

Problem	Presumed cause and solution
The setting indication does not change in the input range even if the △, ▽ keys are pressed, and new values are unable to be set.	• SV high limit or low limit in Auxiliary function setting mode 1 may be set at the point where the value does not change. Set it to a suitable value (SH□□, or SL□□) while in Auxiliary function setting mode 1. (p.31)

<Control>

Problem	Presumed cause and solution
If process variable (temperature) does not rise.	• Thermocouple or RTD is burnt out. • Lead wire of thermocouple or RTD is not securely connected to the instrument terminals. • Direct (Cooling) action [cool] has been selected during the Direct/Reverse action selection [cont] in "5. Setup". Select Reverse (Heating) [HEAT] action. (p.20)
If the control output (OUT) remains in an ON status.	• OUT low limit value is set to 100% or higher in Auxiliary function setting mode 2. (p.17) • The proportional band may be set at an extremely small value. Set it to a suitable value. (p.28)
If the control output (OUT) remains in an OFF status.	• OUT high limit value is set to 0% or less in Auxiliary function setting mode 2. (p.17) • The proportional band may be set at an extremely high value. Set it to a suitable value. (p.28)
Step numbers progress fast and program control stops soon after it has started.	• The program has not been set. Set the program from the Pattern (Step SV/Time) setting mode. (pages 25, 26) • The default value is PV start. If the PV is higher than the Step SV, the program advances and it ends soon. (p.17)
The step does not proceed.	• Wait function is working. Release the wait function. • The fixed value control is performing due to Hold function. Press the RUN Key for more than 1 second to release the Hold function. (p.39)

For all other malfunctions, please contact our main office or dealers.

12. Character table

Photocopiable material

<Pattern (Step SV/Time) setting mode>

Step No.	PV display	Setting item	Default value	Data
1	rEnP	Step 1 SV	0℃	
1	r1 nE	Step 1 time	00.00 (H:M)	
2	rEnP	Step 2 SV	0℃	
2	r1 nE	Step 2 time	00.00 (H:M)	
3	rEnP	Step 3 SV	0℃	
3	r1 nE	Step 3 time	00.00 (H:M)	
4	rEnP	Step 4 SV	0℃	
4	r1 nE	Step 4 time	00.00 (H:M)	
5	rEnP	Step 5 SV	0℃	
5	r1 nE	Step 5 time	00.00 (H:M)	
6	rEnP	Step 6 SV	0℃	
6	r1 nE	Step 6 time	00.00 (H:M)	
7	rEnP	Step 7 SV	0℃	
7	r1 nE	Step 7 time	00.00 (H:M)	
8	rEnP	Step 8 SV	0℃	
8	r1 nE	Step 8 time	00.00 (H:M)	
9	rEnP	Step 9 SV	0℃	
9	r1 nE	Step 9 time	00.00 (H:M)	

<Alarm/Time signal setting mode>

Step No.	PV display	Setting item	Default value	Data
	A 1□	Alarm 1 (A1) value	0℃	
	A2□	Alarm 2 (A2) value	0℃	
	roFF	Time signal OFF time	00.00 (H:M)	
	ron□	Time signal ON time	00.00 (H:M)	

< PID parameter setting mode>

Step No.	PV display	Setting item	Default value	Data
	AT□	Auto-tuning Perform/Cancel	Cancel	
	P□□	Proportional band	10℃	
	I □□	Integral time	200 sec	
	d□□	Derivative time	50 sec	
	n□□	ARW (Anti-reset windup)	50%	
	c□□	Proportional cycle R/□(30 sec), S/□(3 sec)		

<Wait parameter setting mode>

Step No.	PV display	Setting item	Default value	Data
	uAI r	Wait value	0℃(No Wait action)	
1	uAcr	Step 1 Wait function Used/Not used	Not used	
2	uAcr	Step 2 Wait function Used/Not used	Not used	
3	uAcr	Step 3 Wait function Used/Not used	Not used	
4	uAcr	Step 4 Wait function Used/Not used	Not used	

5	uAcr	Step 5 Wait function Used/Not used	Not used	
6	uAcr	Step 6 Wait function Used/Not used	Not used	
7	uAcr	Step 7 Wait function Used/Not used	Not used	
8	uAcr	Step 8 Wait function Used/Not used	Not used	
9	uAcr	Step 9 Wait function Used/Not used	Not used	

<Auxiliary function setting mode 1>

Step No.	PV display	Setting item	Default value	Data
	Lock	Set value lock	Unlock	
	SHxx	SV high limit	1370℃	
	SLxx	SV low limit	-200℃	
	Soxx	Sensor correction	0.0℃	
	cnSL	Communication protocol	Shinko protocol	
	cnno	Instrument number	0	
	cnSP	Communication speed	9600bps	
	cnPr	Parity	Even	
	cnSt	Stop bit	1	

<Auxiliary function setting mode 2>

Step No.	PV display	Setting item	Default value	Data
	SEnS	Input type	K: -200 to 1370℃	
	SrLH	Scaling high limit value	9999	
	SrLL	Scaling low limit value	-1999	
	dPxx	Decimal point place	No decimal point	
	FILt	PV filter time constant	0.0 seconds	
	t_Sx	Step time unit	Hour/Minute	
	S_SB	Step SV for control start	0℃	
	S_SL	Program control start type	PV start	
	oLHx	OUT high limit	100%	
	oLLx	OUT low limit	0%	
	HYSx	OUT ON/OFF hysteresis	1.0℃	
	AL 1F	Alarm 1 (A1) type	No alarm action	
	AL2F	Alarm 2 (A2) type	No alarm action	
	A 1LA	Alarm 1 (A1) Energized/De-energized	Energized	
	A2LA	Alarm 2 (A2) Energized/De-energized	Energized	
	A 1HY	Alarm 1 (A1) hysteresis	1.0℃	
	A2HY	Alarm 2 (A2) hysteresis	1.0℃	
	A 1dY	Alarm 1 (A1) action delay timer	0 sec	
	A2dY	Alarm 2 (A2) action delay timer	0 sec	
	EVSL	Event output function	Time signal output	
	PETn	Pattern end output time	0sec(continuous output)	
	conT	Direct (Cooling)/ Reverse (Heating) control action	Reverse (Heating) control	

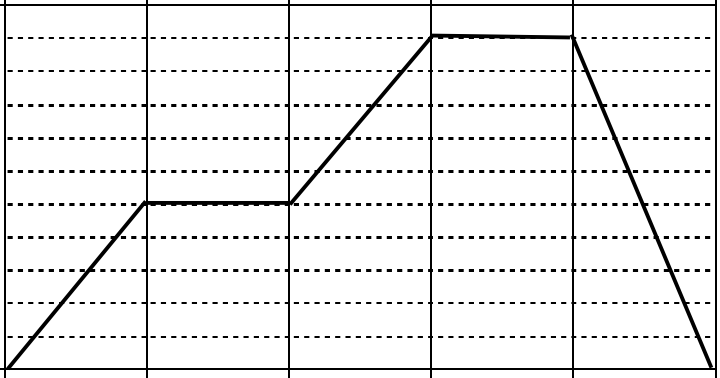
13. Program pattern graphing

Before setting the program, graph a program pattern and data table.
Copy the program pattern table, and follow the procedures below.
(1) Write down the program pattern number.
(2) From Step 1, write down the step SV and step time of each step in sequence.
(3) Write down Alarm 1 (A1) and Alarm 2 (A2) values and Time signal output time.
(4) Write down the P, I, D, ARW and proportional cycle values.
(5) Write down the Wait value and Wait function Used/Not used of each step.
(6) Draw a line graph of the step SV.

Explanation of the program pattern table

Program pattern table consists of Y axis which represents the step SV (℃ or ℉), and X axis which represents the step time (Hour:Min or Min:Sec).
In this context, Step SV is considered to be the value at the end of the step, and step time is considered to be the step processing time.
The relation between the step SV and step time can be explained as follows.
Step 1: The control is performed so that the temperature reaches 500℃ in 30 minutes (0:30). (*1)
Step 2: The control is performed at 500℃ for 1 hour (1:00).
(*1) When the control starts, SV differs depending on the program control start type.
If the SV start is selected during the Program control start type selection, the control starts from SV. If the PV start is selected during the Program control start type selection, the SV is advanced to the PV and the control starts.

Program pattern graphing example

Program pattern (Pattern 1)						
Step number		1	2	3	4	5
SV (Desired value)	1000 500 0					
Step SV (℃)		500	500	1000	1000	0
Step time (Hour:Min)		0:30	1:00	0:40	1:00	2:00
Wait function Used/Not used		Used	Used	Used	Used	Not used
Wait value		1℃				
P (Proportional band)		10℃				
I (Integral time)		200 sec				
D (Derivative time)		50 sec				
ARW		50%				
Proportional cycle		30 sec				
Time signal output	ON OFF					

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Program pattern (Pattern number)				
Step number	1	2	3	4
SV (Desired value)				
Step SV (°C)				
Step time (Hour:Minute)				
Wait function Used/Not used				
Wait value				
P (Proportional band)				
I (Integral time)				
D (Derivative time)				
ARW				
Proportional cycle				
Time signal output ON				
OFF				

5	6	7	8	9

***** Inquiry *****

For any inquiries about this unit, please contact the vendor where you purchased the unit after checking the following.

	[Example]
• Model ----------	PCD-33A-R/M
• Option ----------	C5
• Serial number ----------	No. xxxxxx

In addition to the above, please let us know the details of the malfunction, if any, and the operating conditions.

SHINKO TECHNOS CO., LTD.
OVERSEAS DIVISION

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